CETECOM ICT Services
consulting - testing - certification

TEST REPORT

Test Report No.: 1-1977-01-06/10-A

Deutscher Akkreditierungs Rat DAR

Testing Laboratory

CETECOM ICT Services GmbH
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Accredited Test Laboratory:
The test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025
DAR registration number: DGA-PL-176/94-D1

Area of Testing: Radio Satellite Communications

Applicant

Hirschmann Automation & Control GmbH
Stuttgarter Straße 45-51
72654 Neckartenzlingen/GERMANY
Phone: +49 (0) 7127 14 - 0
Fax: +49 (0) 7127 14 - 1600
Contact: Robert Binder
e-mail: Robert.Binder@Belden.com
Phone: +49 7127 14-1750

Manufacturer

Hirschmann Automation & Control GmbH
Stuttgarter Straße 45-51
72654 Neckartenzlingen/GERMANY

Test Standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I-Federal Communications Commission subchapter A - general, Part 15-Radio frequency devices
RSS - 210 Issue 7	Spectrum Management and Telecommunications - Radio Standards Specification Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	WLAN Access Point (IEEE 802.11 a/b/g)
Model name:	BAT54-Rail
FCC ID:	U99BAT54RAIL
IC:	4019A-BAT54R
Frequency [MHz]:	ISM band 2400 MHz – 2483.5 MHz (low channel 2412 MHz / high channel 2462 MHz)
Power supply:	115 V AC by mains adapter SMP – 120 W
Temperature range:	-30 °C to +55 °C

Test performed:

2010-08-24 Marco Bertolino

Test Report authorised:

2010-08-24 Andreas Keller

1 Table of contents

2 General Information

2.1 Notes

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.
This test report is electronically signed and valid without handwriting signature. For verification of the electronical signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2010-02-04
Date of receipt of test item:	2010-07-26
Start of test:	2010-07-28
End of test:	2010-08-09
Person(s) present during the test:	-/-

3 Test standard/s

Test Standard	Version	Test Standard Description
47 CFR Part 15	2009-10	Title 47 of the Code of Federal Regulations; Chapter I-Federal Communications Commission subchapter A - general, Part 15-Radio frequency devices
RSS - 210 Issue 7	2007-06	Spectrum Management and Telecommunications - Radio Standards Specification Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

4 Test Environment

Temperature:	T_{nom}	+22 °C during room temperature tests
	T_{max}	+55 °C during high temperature test
	T_{min}	-30 °C during low temperature test
Relative humidity content:		52 %
Air pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	115.00 V AC by mains adapter SMP – 120 W
	V_{max}	132.25 V
	V_{min}	97.75 V

5 Test item

Kind of test item	:	WLAN Access Point (IEEE 802.11 a/b/g)
Type identification	:	BAT54-Rail
S/N serial number	:	S/N: 943926021000110207 MAC: 008063AEBE64
HW hardware status	:	No information available!
SW software status	:	No information available!
Frequency Band [MHz]	:	ISM band 2400 MHz – 2483.5 MHz (low channel 2412 MHz / high channel 2462 MHz)
Type of Modulation	:	DSSS & OFDM technology with BPDK; QPSK; 16-QAM; 64-QAM
Number of channels	:	11
Antenna	:	1 external antennas: BAT-ANT_N_LC-G-50m-IP65 For more information, please take a look at the references documents and annex B – external photos of the EUT!
Power Supply	:	115 V AC by mains adapter SMP – 120 W
Temperature Range	:	-30℃ to +55 ℃

6 Test Laboratories sub-contracted

None

7 Summary of measurement results

☒	**No deviations from the technical specifications were ascertained**
☐	There were deviations from the technical specifications ascertained

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210, Issue 7, Annex 8	Passed	2010-08-24	Delta tests only!

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	Mode	Pass	Fail	NA	NP	Results (max.)
§15.247(b)(4) RSS 210 / A8.4(2)	Antenna Gain	Nominal	Nominal	OFDM	☒	☐	☐	☐	complies
§15.247(e) RSS 210 / A8.2(b)	Power spectral density	Nominal	Nominal	OFDM	☐	☐	☐	☒	-/-
§15.247(a)(2) RSS 210 / A8.2(a)	Spectrum bandwidth of a FHSS system 6dB bandwidth	Nominal	Nominal	OFDM	☐	☐	☐	☒	-/-
§15.247(a)(2) RSS 210 / A8.2(a)	Spectrum bandwidth of a FHSS system 20dB bandwidth	Nominal	Nominal	OFDM	☐	☐	☐	☒	-/-
§15.247(b)(3) RSS-210 / A8.4(4)	Maximum output power	Nominal	Nominal	OFDM	☒	☐	☐	☐	complies
§15.247(d) RSS-210 / A8.5	Band edge compliance conducted	Nominal	Nominal	OFDM	☐	☐	☐	☒	-/-
§15.205 RSS-210 / A8.5	Band edge compliance radiated	Nominal	Nominal	OFDM	☒	☐	☐	☐	complies
§15.247(d) RSS-210 / A8.5	TX spurious emissions conducted	Nominal	Nominal	OFDM	☐	☐	☐	☒	-/-
§15.247(d) RSS-210 / A8.5	TX spurious emissions radiated	Nominal	Nominal	OFDM	☒	☐	☐	☐	complies
§15.109 RSS-Gen.	RX spurious emissions radiated	Nominal	Nominal	-/-	☒	☐	☐	☐	complies
§15.209(a) RSS-Gen	TX spurious emissions radiated < 30 MHz	Nominal	Nominal	OFDM	☒	☐	☐	☐	complies
§15.107(a)	Conducted emissions < 30 MHz	Nominal	Nominal	OFDM	☐	☐	☐	☒	-/-

Note: NA = Not Applicable; NP = Not Performed

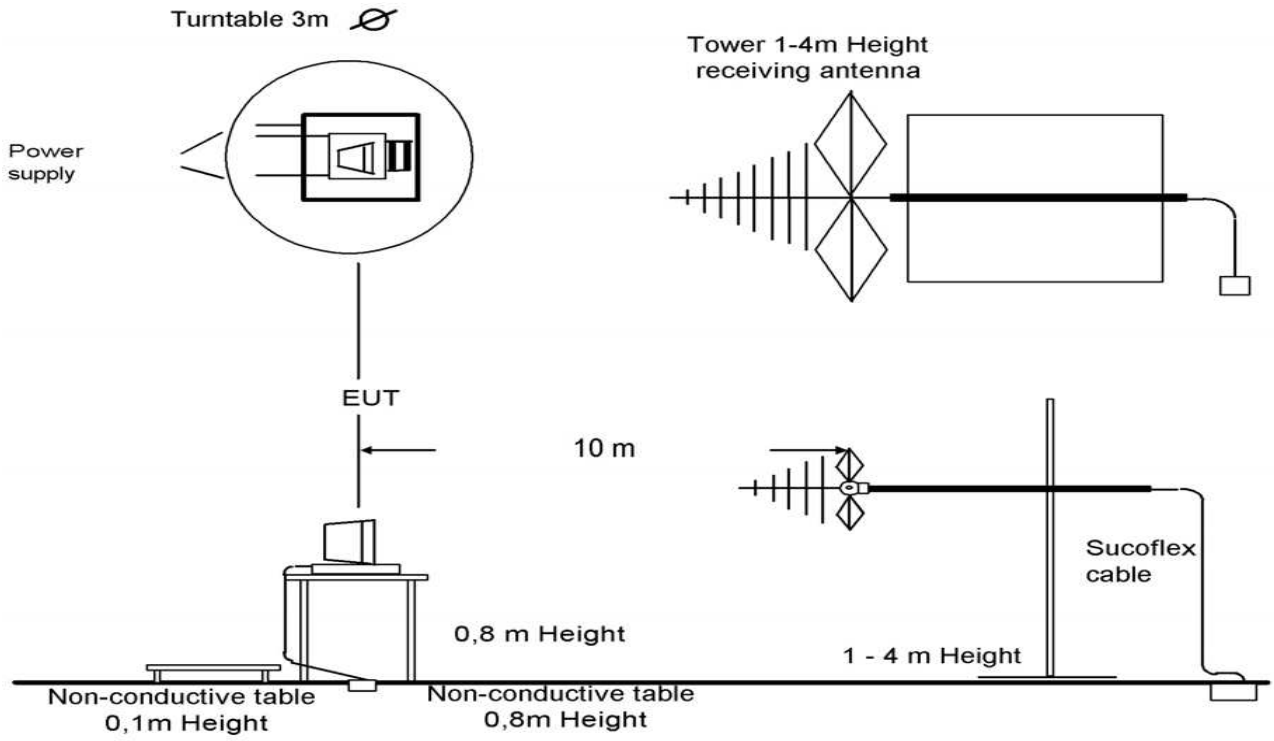
8 RF measurement testing

8.1 Description of test setup

8.1.1 Radiated measurements

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2003 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-2003 clause 4.2.
Antennas are confirmed with ANSI C63.2-1996 item 15.

Semi anechoic chamber



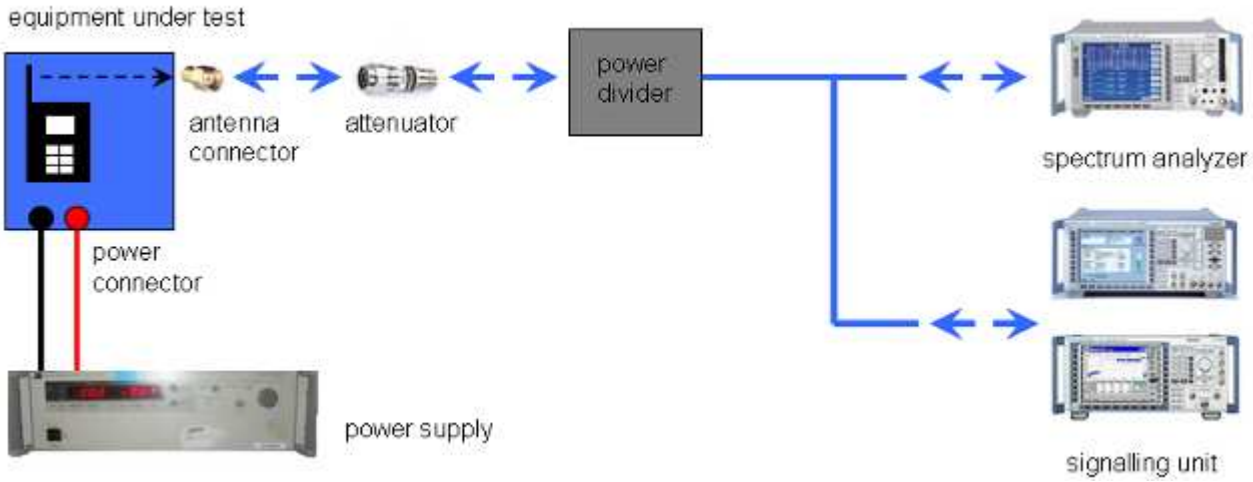
Picture 1: Diagram radiated measurements

9 kHz - 30 MHz:	active loop antenna
30 MHz – 1 GHz:	tri-log antenna
> 1 GHz:	horn antenna

The EUT is powered by an external power supply with nominal voltage. The signalling is performed from outside the chamber with a signalling unit (CMU200 or other) by air link using signalling antenna.

8.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is power divided (~6dB loss per branch). One of the signal paths is connected to the communication base Station (CMU200 or other), the other one is connected to the spectrum analyzer. The specific losses for both signal paths are first checked within a calibration. The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signalling unit and the spectrum analyzer are impedance matched on 50 Ohm.



Picture 2: Diagram conducted measurements

8.2 Additional comments

Reference documents:

HIRSCHMANN
A BELDEN BRAND

Radiating Cable Antennas (Leaky Cable)

Antennas for 2,4 GHz

Radiating cables are in fact coaxial cables that are equipped with small slots that operate as antennas. This leads to a homogeneous field around the cable in which clients can move without roaming.

The 100m cable is designed for feeding the signal from both ends. The 50m cable is designed to be used with one AP and equipped with a terminator at the end.

BAT-ANT-N-LC-G-50m-IP65

Order Number 943 981-001

Specification

Cable length	50 m
Cable specification	N male connector, N-terminator; 1.5 dB at 2.4GHz
Radio technology	
Frequency band	2000 MHz - 2900 MHz
Antenna connector	N-type male
Ambient conditions	
Operating temperature	-40 °C to +85 °C
Storage/transport temperature	-70 °C to +85 °C
Dimensions (W x H x D)	50m; d=15mm
Mounting	wall
Protection class	IP 65
Weight	12 kg

Fire behavior

Halogen free and flame retardant outer sheath
Low corrosive gas emission acc. to IEC 60754-2
Flame retardant acc. to IEC 60332-1 and IEC 60332-3 cat. C
Low smoke emission acc. to IEC 61034

Scope of delivery and accessories

Leaky Cable, 2 x N-connector preassembled, 1 x terminator 50 Ohm, 50 x fastening clip

www.hirschmann.com

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HIRSCHMANN
A BELDEN BRAND

BAT-ANT-N-LC-G-100m-IP65

Order Number 943 981-101

Specification

Cable length	100 m
Cable specification	2 x N male connectors; 1.5 dB at 2.4GHz
Radio technology	
Frequency band	2000 MHz - 2900 MHz
Antenna connector	N-type male
Ambient conditions	
Operating temperature	-40 °C to +85 °C
Storage/transport temperature	-70 °C to +85 °C
Dimensions (W x H x D)	100m; d=15mm
Mounting	wall
Protection class	IP 65
Weight	24 kg

Fire behavior

Halogen free and flame retardant outer sheath
Low corrosive gas emission acc. to IEC 60754-2
Flame retardant acc. to IEC 60332-1 and IEC 60332-3 cat. C
Low smoke emission acc. to IEC 61034

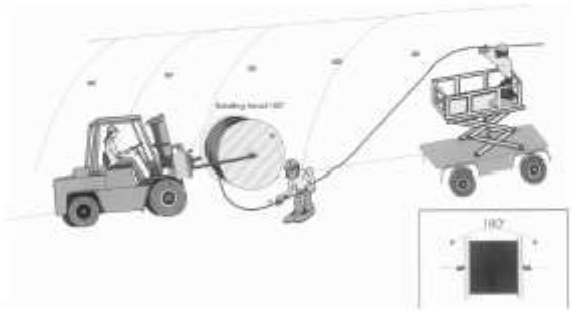
Scope of delivery and accessories

Leaky Cable, 2 x N-connector preassembled, 1 x terminator 50 Ohm, 100 x fastening clip

Longitudinal attenuation of both cables between 2.4 and 2.485 GHz

Configurations Longitudinal Attenuation

	dB/100 m
LC at 10 cm from a concrete floor	15
LC at 15 mm from a metal surface	17
LC directly against a metal surface	34



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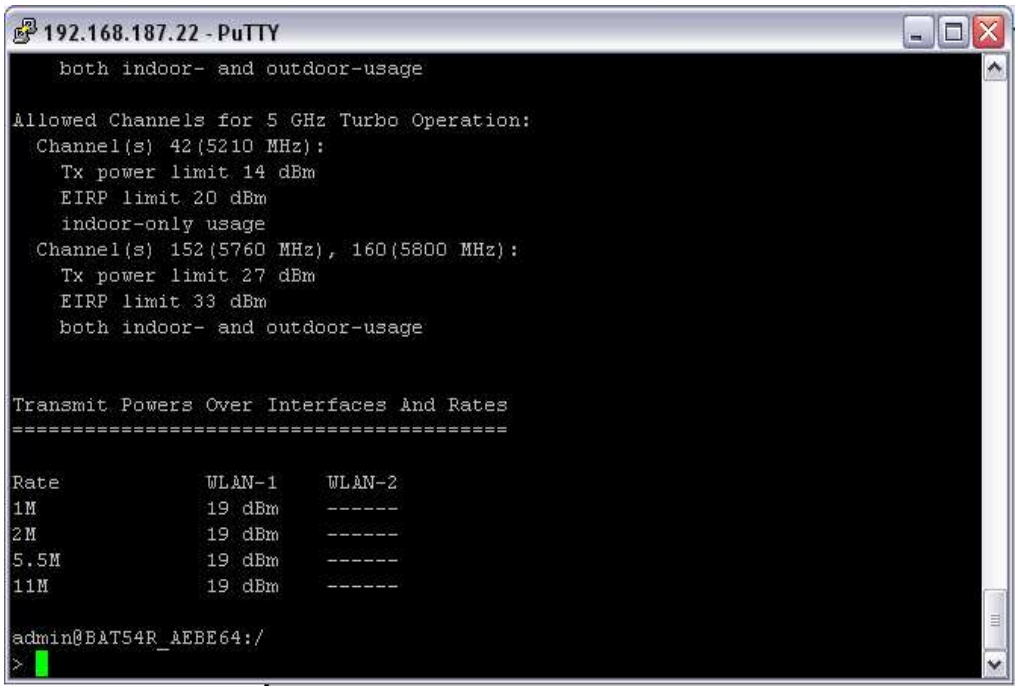
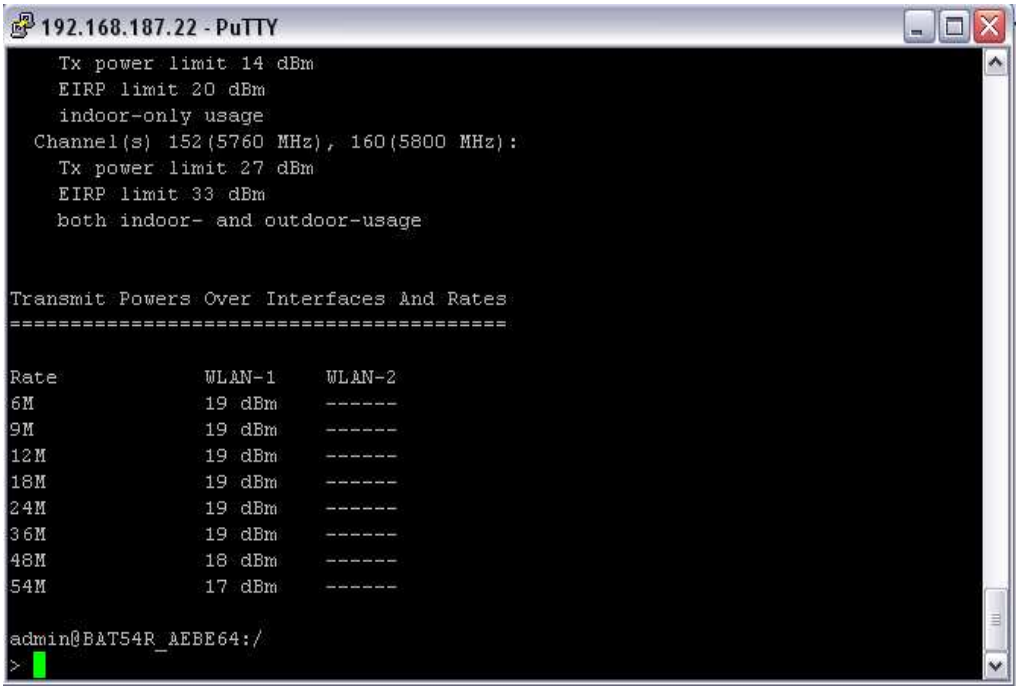
Special test descriptions:

Plot: Test software

B – mode:



G – mode:



All measurements are in the low data rate condition performed.

Configuration descriptions: None

Test mode:

☐ No test mode available.
Iperf was used to ping an other device with the largest support packet size

☒ Special software is used.
EUT is transmitting pseudo random data by itself

8.3 RSP100 Test Report Cover Sheet / Performance Test Data

Test Report Number	:	1-1977-01-06/10-A
Equipment Model Number	:	BAT54-Rail
Certification Number	:	4019A-BAT54R
Manufacturer (complete Address)	:	Hirschmann Automation & Control GmbH Stuttgarter Straße 45-51 72654 Neckartenzlingen / GERMANY
Tested to radio standards specification no.	:	RSS 210, Issue 7, Annex 8
Open Area Test Site IC No.	:	IC 3462C-1
Frequency Range	:	ISM band 2400 MHz – 2483.5 MHz (low channel 2412 MHz / high channel 2462 MHz)
RF-power [W] (max.)	:	cond. B -mode: 21.97 dBm 157.40 mW cond. G -mode: 27.07 dBm 509.33 mW EIRP: BAT-ANT_N_LC-G-50m-IP65 B – mode (4 m) 21.37 dBm 137.09 mW G – mode (4 m) 26.47 dBm 443.61 mW
Occupied bandwidth (99%-BW) [kHz]	:	Not performed! Delta tests only!
Type of modulation	:	DSSS & OFDM technology with BPDK; QPSK; 16-QAM; 64-QAM
Emission Designator (TRC-43)	:	Not performed! Delta tests only!
Antenna Information	:	1 external antennas: BAT-ANT_N_LC-G-50m-IP65 For more information, please take a look at the references documents and additional comments!
Transmitter Spurious (worst case) [dBµV/m @ 3m]:		BAT-ANT_N_LC-G-50m-IP65: 50.8
Receiver Spurious (worst case) [dBµV/m @ 3m]:		BAT-ANT_N_LC-G-50m-IP65: 50.3

ATTESTATION:
DECLARATION OF COMPLIANCE:

I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.

Laboratory Manager:

2010-08-24	Marco Bertolino	
Date	Name	Signature

9 Measurement Results

9.1 Antenna Gain

Measurement:

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal WLAN devices, the DSSS mode is used.

Measurement parameters:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	1 MHz
Resolution bandwidth:	1 MHz
Span:	30 MHz
Trace-Mode:	Max hold

Limits:

FCC	IC
CFR Part 15.247 (b)(4)	RSS 210, Issue 7, A 8.4(2)
Antenna Gain	
6 dBi	

Results: BAT-ANT_N_LC-G-50m-IP65

B – mode:

T_{nom}	V_{nom}	lowest channel 2412 MHz	middle channel 2437 MHz	highest channel 2462 MHz
Conducted power [dBm] Measured with DSSS modulation		21.97	21.08	21.40
Radiated power [dBm] Calculated		21.37	20.48	20.80
Gain [dBi] Calculated		-0.6*	-0.6*	-0.6*

G – mode:

T_{nom}	V_{nom}	lowest channel 2412 MHz	middle channel 2437 MHz	highest channel 2462 MHz
Conducted power [dBm] Measured with OFDM modulation		27.07	26.60	26.54
Radiated power [dBm] Calculated		26.47	26.00	25.94
Gain [dBi] Calculated		-0.6*	-0.6*	-0.6*

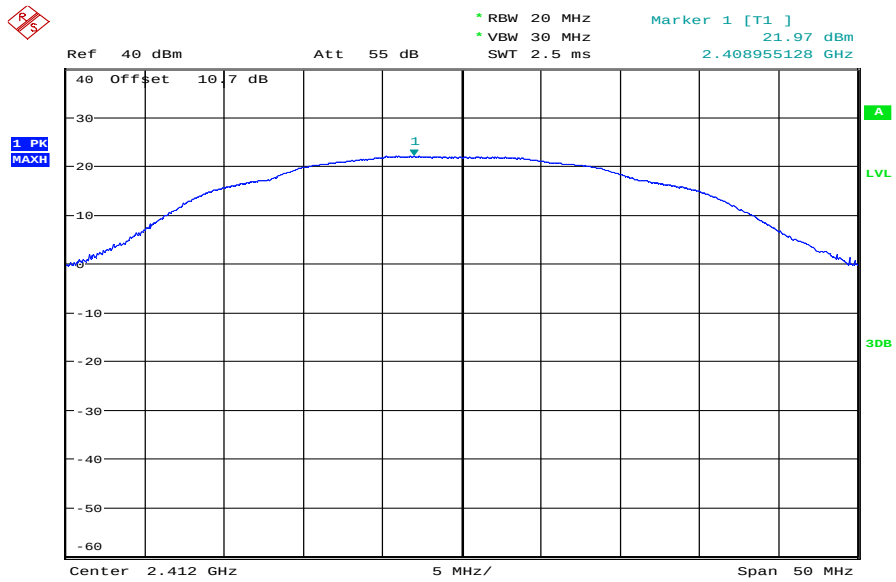
*** Note:**

Attenuation: 15dB / 100 m

→ 0.6 dB / 4 m

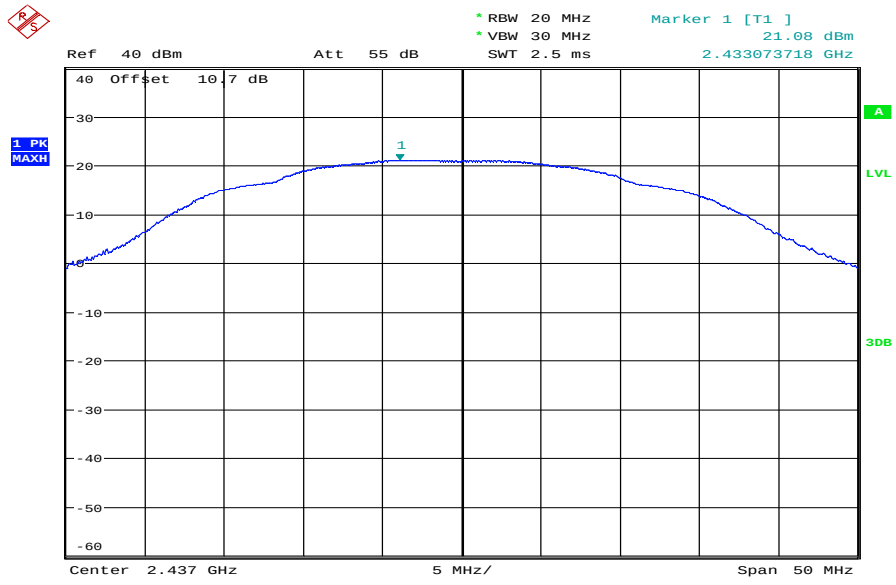
Result: **The result of the measurement is passed.**

Plot 1: TX mode, low channel – 2412 MHz, conducted power, b – mode



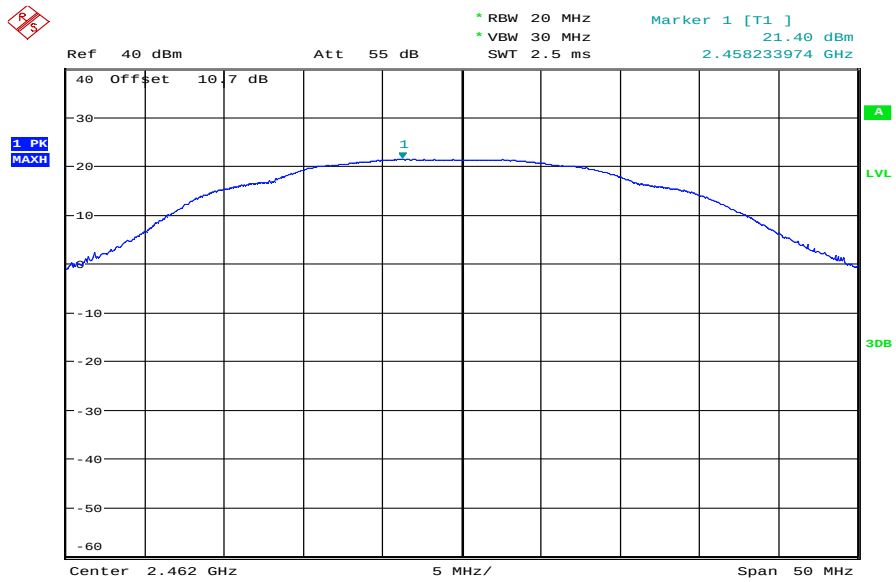
Date: 9.AUG.2010 13:28:15

Plot 2: TX mode, mid channel – 2437 MHz, conducted power, b – mode



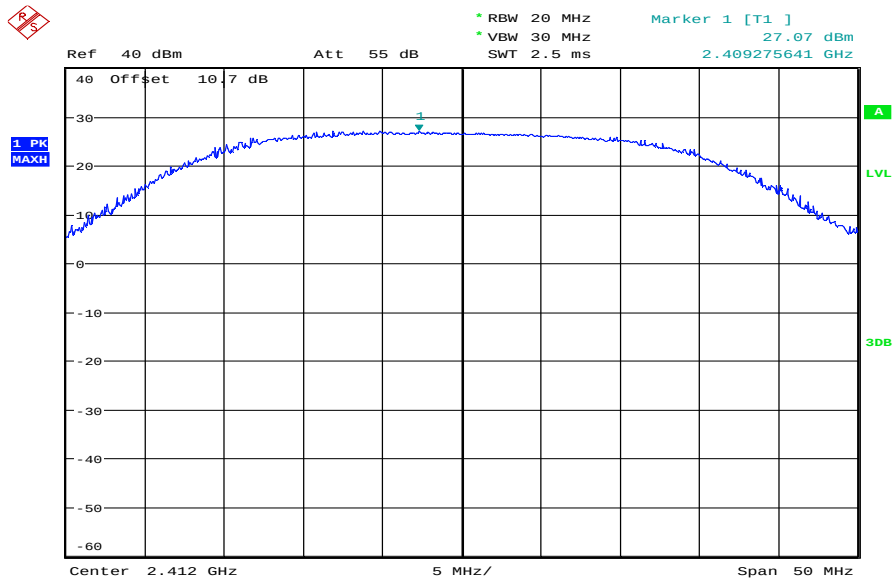
Date: 9.AUG.2010 13:28:58

Plot 3: TX mode, high channel – 2462 MHz, conducted power, b – mode



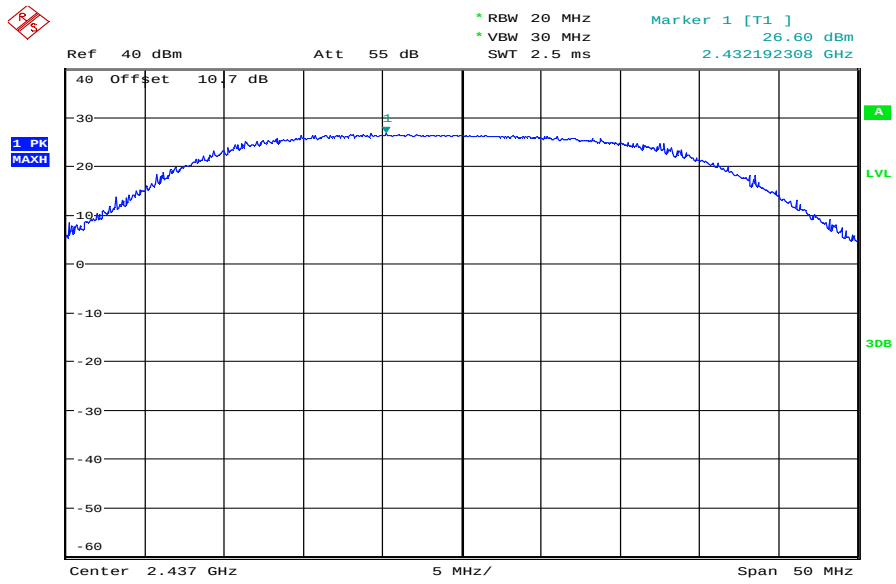
Date: 9.AUG.2010 13:29:39

Plot 4: TX mode, low channel – 2412 MHz, conducted power, g – mode

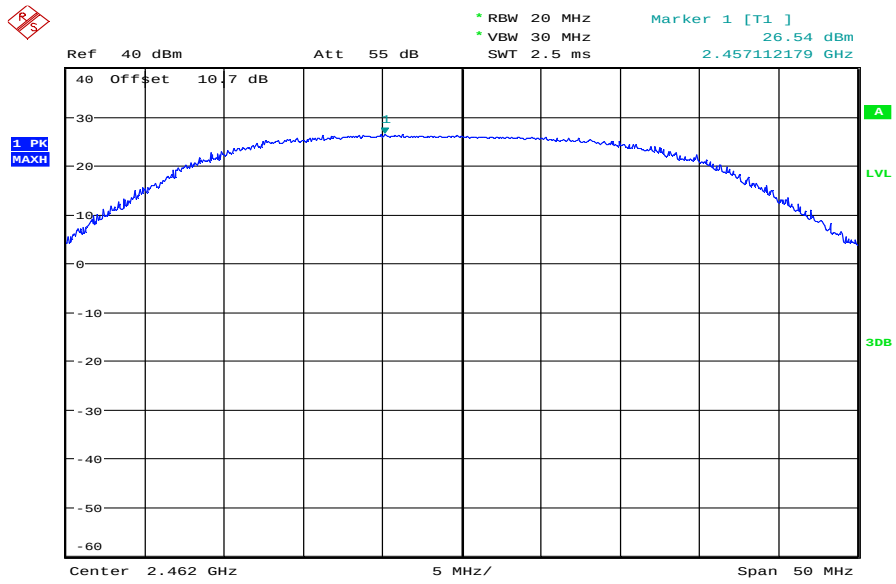


Date: 9.AUG.2010 13:32:23

Plot 5: TX mode, mid channel – 2437 MHz, conducted power, g – mode



Plot 6: TX mode, high channel – 2462 MHz, conducted power, g – mode



9.2 Power Spectral Density

Not performed!
Delta tests only!

Description:

Measurement of the power spectral density of a digital modulated system. The measurement is repeated for both modulations at the lowest, middle and highest channel.

Measurement:

Measurement parameter	
Detector:	
Sweep time:	
Video bandwidth:	
Resolution bandwidth:	
Span:	
Trace-Mode:	

Limits:

FCC	IC
CFR Part 15.247 (e)	RSS 210, Issue 7, A 8.2(b)
Power Spectral Density	
The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0-second duration.	

Result:

Modulation / Frequency	Power Spectral density [dBm/3kHz]		
OFDM			
Measurement uncertainty	± 0.5 dB		

Result: -/-

9.3 Spectrum Bandwidth of a FHSS System – 6 dB Bandwidth

Not performed!
Delta tests only!

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
Detector:	
Sweep time:	
Video bandwidth:	
Resolution bandwidth:	
Span:	
Trace-Mode:	

Limits:

FCC	IC
CFR Part 15.247 (a)(2)	RSS 210, Issue 7, A 8.2(a)
Spectrum Bandwidth of a FHSS System – 6 dB Bandwidth	
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.	

Result:

Modulation	6 dB BANDWIDTH [MHz]		
Frequency			
OFDM			
Measurement uncertainty	± 100 kHz		

Result: -/-

9.4 Spectrum Bandwidth of a FHSS System – 20 dB Bandwidth

Not performed!
Delta tests only!

Description:

Measurement of the 20 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
Detector:	
Sweep time:	
Video bandwidth:	
Resolution bandwidth:	
Span:	
Trace-Mode:	

Limits:

FCC	IC
CFR Part 15.247 (a)(2)	RSS 210, Issue 7, A 8.2(a)
Spectrum Bandwidth of a FHSS System – 20 dB Bandwidth	
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.	

Result:

Modulation Frequency	20 dB BANDWIDTH [MHz]		
OFDM			
Measurement uncertainty	± 100 kHz		

Result: -/-

9.5 Maximum Output Power

Description:

Measurement of the maximum output power conducted and radiated. The measurements are performed using the data rate producing the highest conducted output power. The determination of these data rates was performed at the beginning of the tests. Additionally the average power is measured using a wideband power meter.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	30 MHz
Resolution bandwidth:	50 MHz
Span:	30 MHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
CFR Part 15.247 (b)(3)	RSS 210, Issue 7, A 8.4(4)
Maximum Output Power	
Conducted: 1.0 W – Antenna Gain max. 6 dBi	

Result: BAT-ANT_N_LC-G-50m-IP65

DSSS	Maximum Output Power [dBm]		
Frequency	lowest channel 2412 MHz	middle channel 2437 MHz	highest channel 2462 MHz
Peak Output Power Conducted	21.97	21.08	21.40
Output Power Radiated - EIRP	21.37	20.48	20.80
Measurement uncertainty	± 0.5 dB (cond.) / ± 2 dB (rad.)		

OFDM	Maximum Output Power [dBm]		
Frequency	lowest channel 2412 MHz	middle channel 2437 MHz	highest channel 2462 MHz
Peak Output Power Conducted	27.07	26.60	26.54
Output Power Radiated - EIRP	26.47	26.00	25.94
Measurement uncertainty	± 0.5 dB (cond.) / ± 2 dB (rad.)		

Result: **The result of the measurement is passed.**

9.6 Band Edge Compliance Conducted

Not performed!
Delta tests only!

Description:

Measurement of the conducted band edge compliance. EUT is measured at the lower and upper band edge in both modes.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	100 kHz
Resolution bandwidth:	100 kHz
Span:	-/-
Trace-Mode:	Max Hold

Limits:

FCC	IC
CFR Part 15.247 (d)	RSS 210, Issue 7, A 8.5
Band Edge Compliance Conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.	

Result:

Szenario	Band Edge Compliance Conducted [dB]	
Modulation	-/-	-/-
Lower Band Edge	-/-	-/-
Upper Band Edge	-/-	-/-
Measurement uncertainty	± 1.5 dB	

Result: -/-

9.7 Band Edge Compliance Radiated

Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to channel 1 for the lower restricted band and to channel 11 for the upper restricted band. The measurement is repeated for all modulations. Measurement distance is 3m.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	10 Hz
Resolution bandwidth:	1 MHz
Span:	-/-
Trace-Mode:	Max Hold

Limits:

FCC	IC
CFR Part 15.205	RSS 210, Issue 7, A 8.5
Band Edge Compliance Radiated	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).	
54 dBµV/m AVG	

Result:

Szenario	Band Edge Compliance Radiated [dBµV/m]	
Technology	DSSS	OFDM
Lower Band Edge	30.0	38.9
Upper Band Edge	38.3	40.2
Measurement uncertainty	± 3 dB	

Result: **The results of the measurement is passed!**

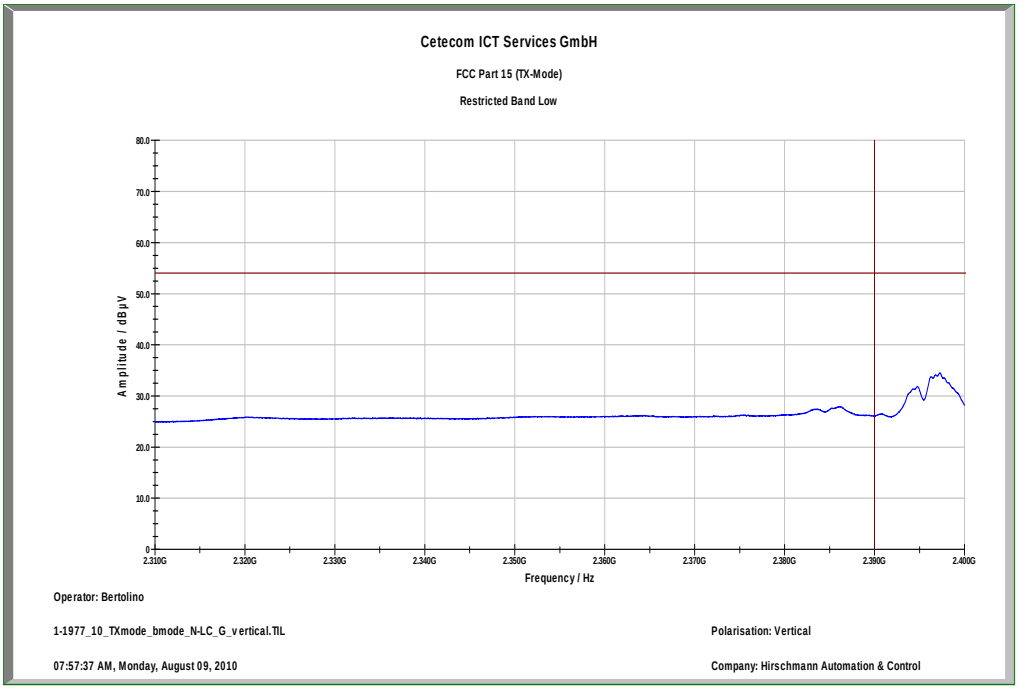
Results:

Section 15.205 Restricted bands of operation.

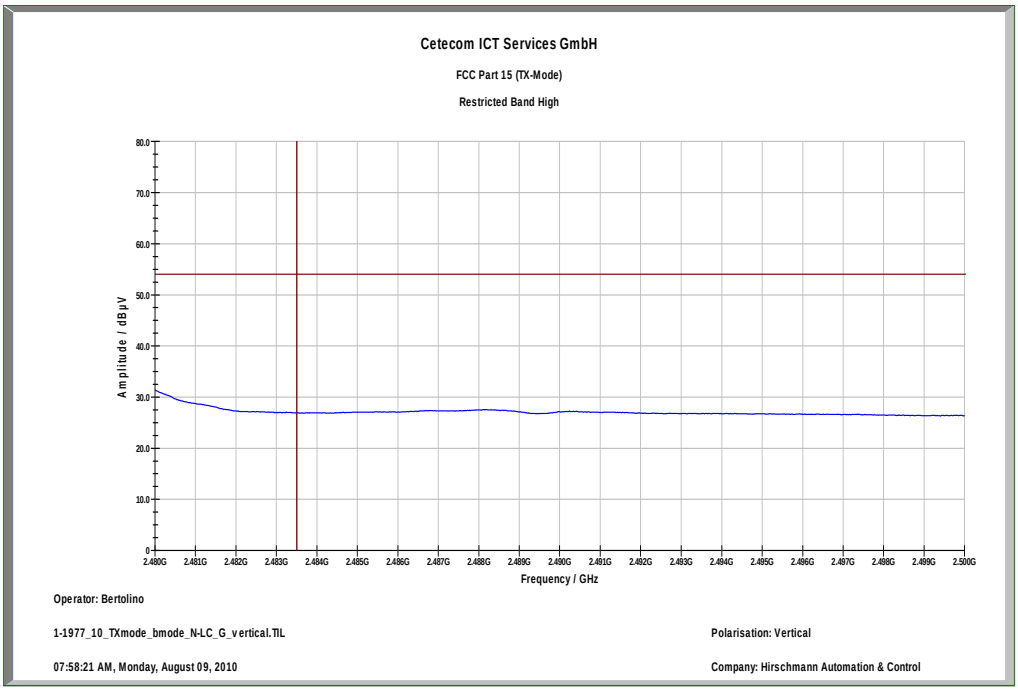
(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

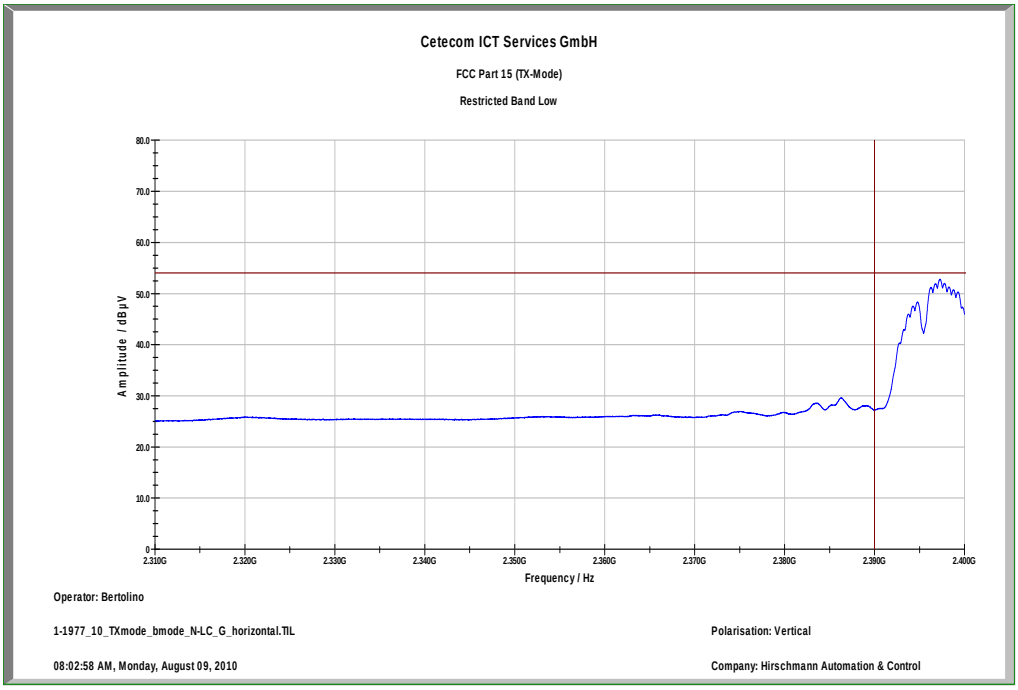
Plot 1: TX mode, lower band edge, DSSS mode, vertical polarization



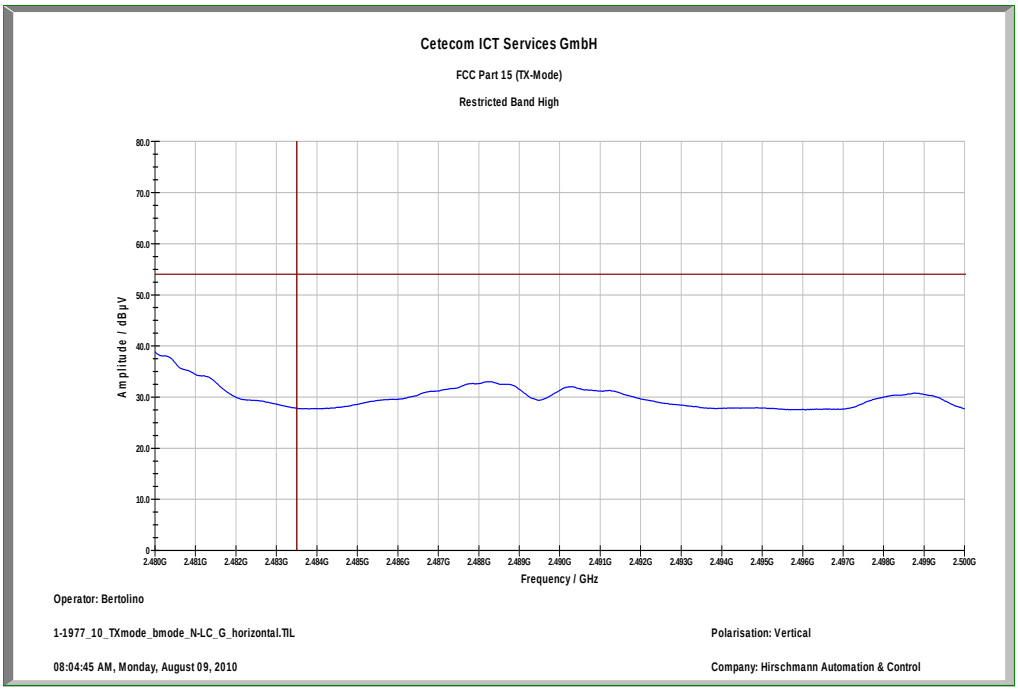
Plot 2: TX mode, upper band edge, DSSS mode, vertical polarization



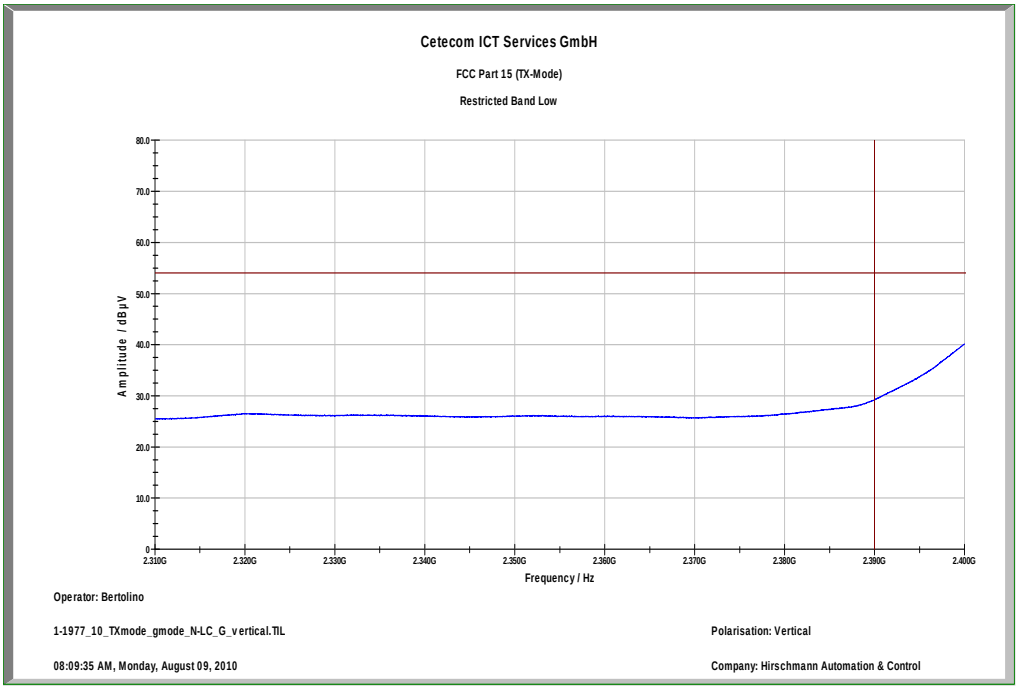
Plot 3: TX mode, lower band edge, DSSS mode, horizontal polarization



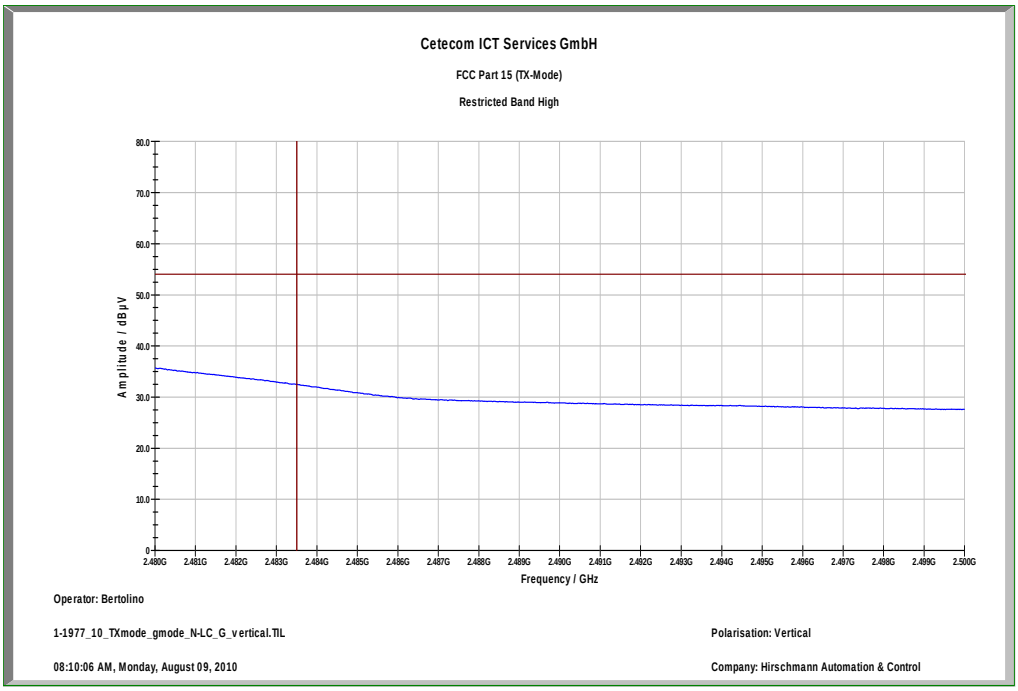
Plot 4: TX mode, upper band edge, DSSS mode, horizontal polarization



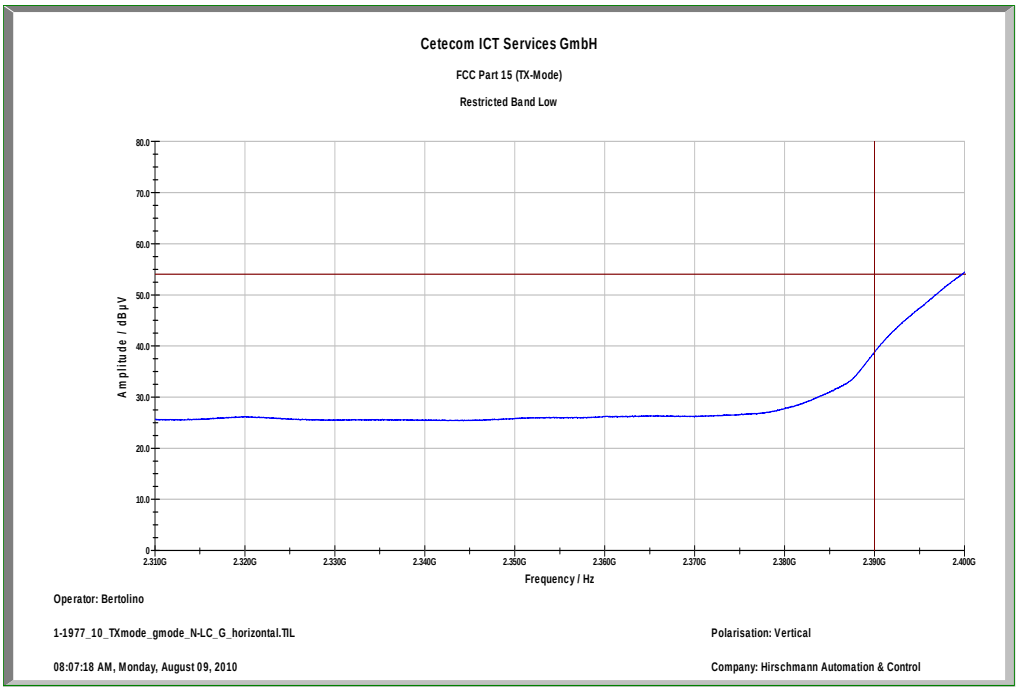
Plot 5: TX mode, lower band edge, OFDM mode, vertical polarization



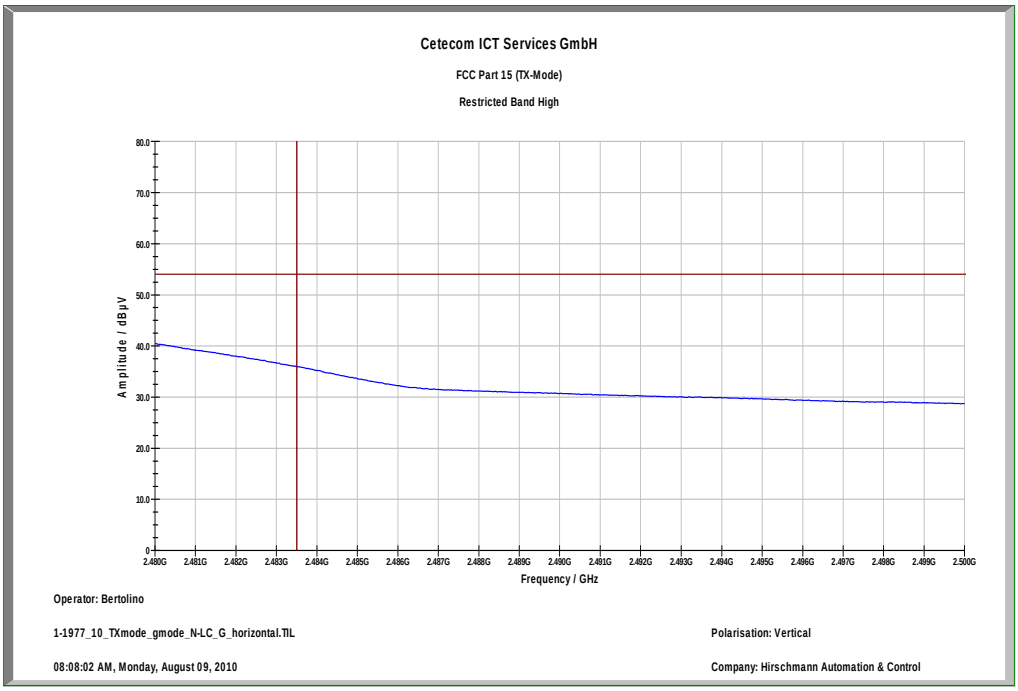
Plot 6: TX mode, upper band edge, OFDM mode, vertical polarization



Plot 7: TX mode, lower band edge, OFDM mode, horizontal polarization



Plot 8: TX mode, upper band edge, OFDM mode, horizontal polarization



9.8 TX Spurious Emissions Conducted

Not performed!
Delta tests only!

Description:

Measurement of the conducted spurious emissions in transmit mode. The measurement is performed at channel 1, 6 and 11. The measurement is repeated for all modulations.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Span:	9 kHz to 25 GHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
CFR Part 15.247(d)	RSS 210, Issue 7, A 8.5
TX Spurious Emissions Conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required	

Result:

TX Spurious Emissions Conducted					
DSSS - mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2412			30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
2437			30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
2462			30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
Measurement uncertainty		± 3 dB			

TX Spurious Emissions Conducted					
OFDM - mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2412			30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
2437			30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
2462			30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
Measurement uncertainty		± 3 dB			

Result: -/-

9.9 TX Spurious Emissions Radiated

Description:

Measurement of the conducted spurious emissions in transmit mode. The measurement is performed at channel 1, 6 and 11. The measurement is repeated for all modulations.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	Sweep: 100 kHz Remeasurement: 10 Hz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Span:	30 MHz to 25 GHz
Trace-Mode:	Max Hold
Measured Modulation	☐ DSSS ☒ OFDM

The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

Limits:

FCC	IC	
CFR Part 15.247(d)	RSS 210, Issue 7, A 8.5	
TX Spurious Emissions Radiated		
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).		
§15.209		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

Result: BAT-ANT_N_LC-G-50m-IP65

TX Spurious Emissions Radiated [dBµV/m]								
OFDM - mode								
5745 MHz			5785 MHz			5825 MHz		
F	Detector	Level [dBµV/m]	F	Detector	Level [dBµV/m]	F	Detector	Level [dBµV/m]
Please take a look at the table below the plot!			Please take a look at the table below the plot!			Please take a look at the table below the plot!		
Measurement uncertainty			± 3 dB					

Result: **The result of the measurement is passed.**

Antenna: BAT-ANT_N_LC-G-50m-IP65

B –mode:

Plot 1: TX mode, low channel – 2412 MHz, 30 MHz – 1GHz, vertical & horizontal polarization

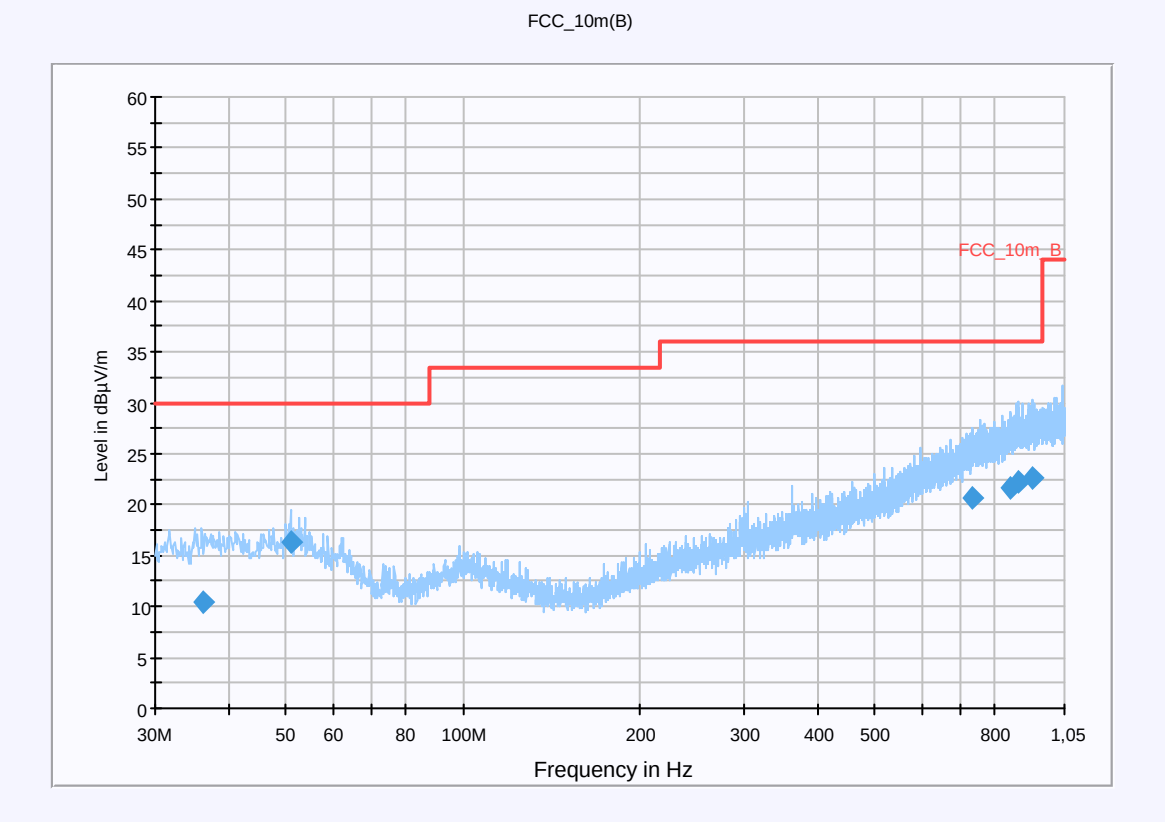
Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 943926022010110004
Test Description:	FCC part 15 C Class B @ 10 m
Operating Conditions:	WLAN b-mode; Continous Tx; Ch: 1 (2412 MHz)
Operator Name:	Lang
Comment:	

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dBµV/m

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1,05 GHz	QuasiPeak	120 kHz	15 s	Receiver



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
36.133950	10.4	15000.000	120.000	142.0	V	123.0	13.1	19.6	30.0	
51.004950	16.4	15000.000	120.000	104.0	V	114.0	13.3	13.6	30.0	
732.888750	20.6	15000.000	120.000	230.0	V	282.0	23.2	15.4	36.0	
848.527050	21.7	15000.000	120.000	198.0	H	211.0	24.5	14.3	36.0	
879.214050	22.3	15000.000	120.000	198.0	H	292.0	24.9	13.7	36.0	
928.268850	22.6	15000.000	120.000	386.0	V	54.0	25.3	13.4	36.0	

Hardware Setup: **EMI radiated\Electric Field (NOS) - [EMI radiated]**

Subrange 1	
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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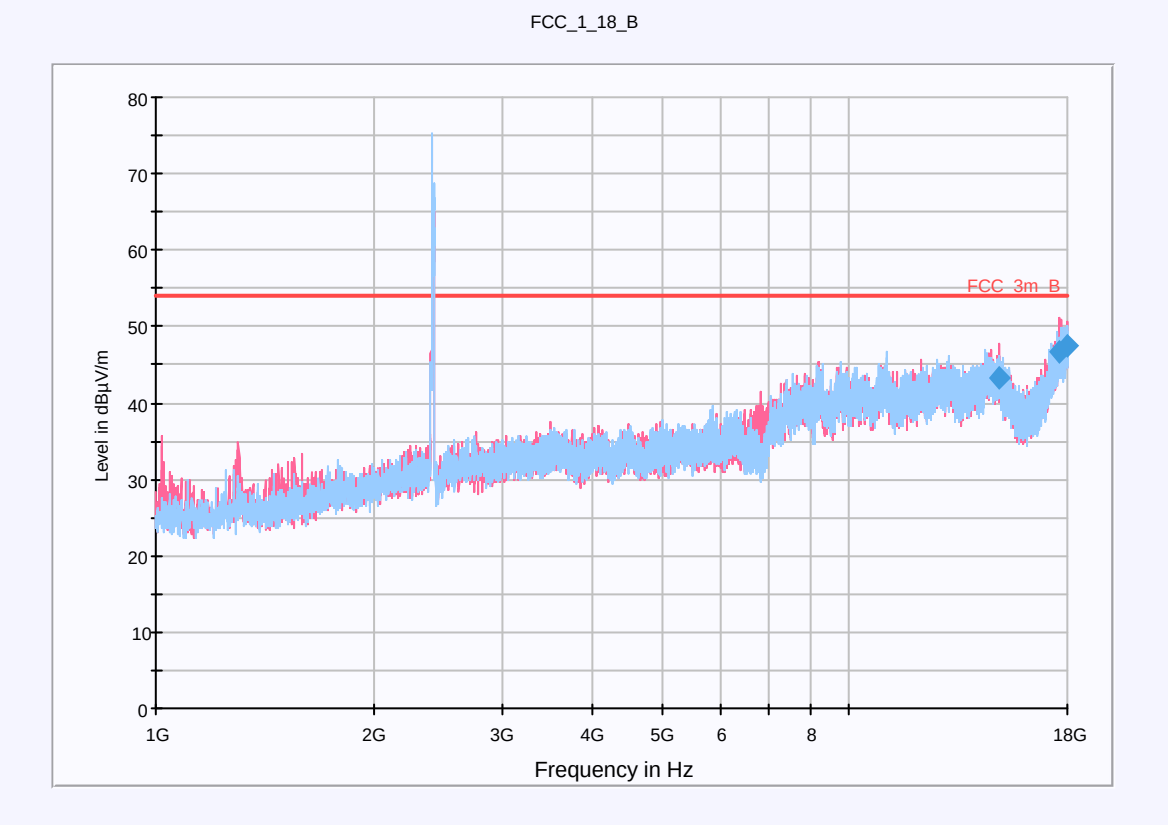
Plot 2: TX mode, low channel – 2412 MHz, 1 GHz – 18GHz, vertical & horizontal polarization

Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 943926022010110004
Test Description:	FCC part 15 C Class B @ 3m
Operating Conditions:	WLAN b-mode; Continous Tx; Ch: 1 (2412 MHz)
Operator Name:	Lang
Comment:	



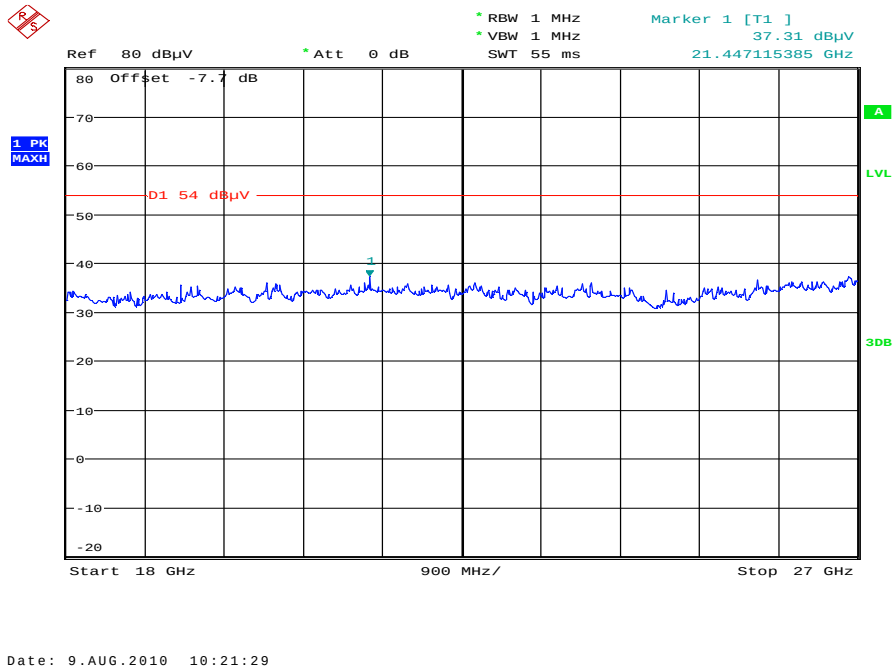
Final Result 1

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
14517.782750	43.2	1.000	1000.000	128.0	V	290.0	7.2	10.8	54.0	
17538.114750	46.7	1.000	1000.000	128.0	V	45.0	11.4	7.3	54.0	
...	...	...	...	...	...	...	...	...	...	...

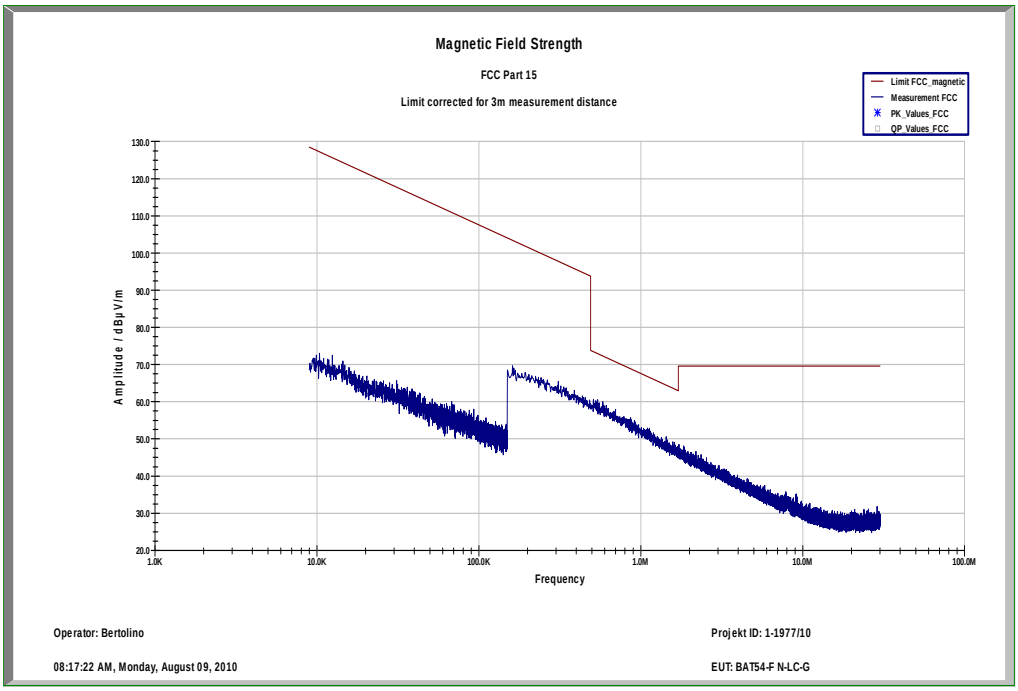
Hardware Setup: **EMI radiated\FSU_1_18_FCC - [EMI radiated]**

Subrange 1	
Frequency Range:	1 GHz - 18 GHz
Receiver:	FSU 26 [FSU 26] @ GPIB0 (ADR 21), SN 200809/026, FW 4.41
Signal Path:	1_18_FCC FW 1.0
Antenna:	FCC_Horn Correction Table (vertical): EMCO 3115_EN Correction Table (horizontal): EMCO 3115_EN Correction Table: LNA + Cabel_FCC (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

Plot 3: TX mode, low channel – 2412 MHz, 18 GHz – 27 GHz, vertical & horizontal polarization



Plot 4: TX mode, mid channel – 2437 MHz, 9 kHz – 30 MHz, magnetic



Plot 5: TX mode, mid channel – 2437 MHz, 30 MHz – 1GHz, vertical & horizontal polarization

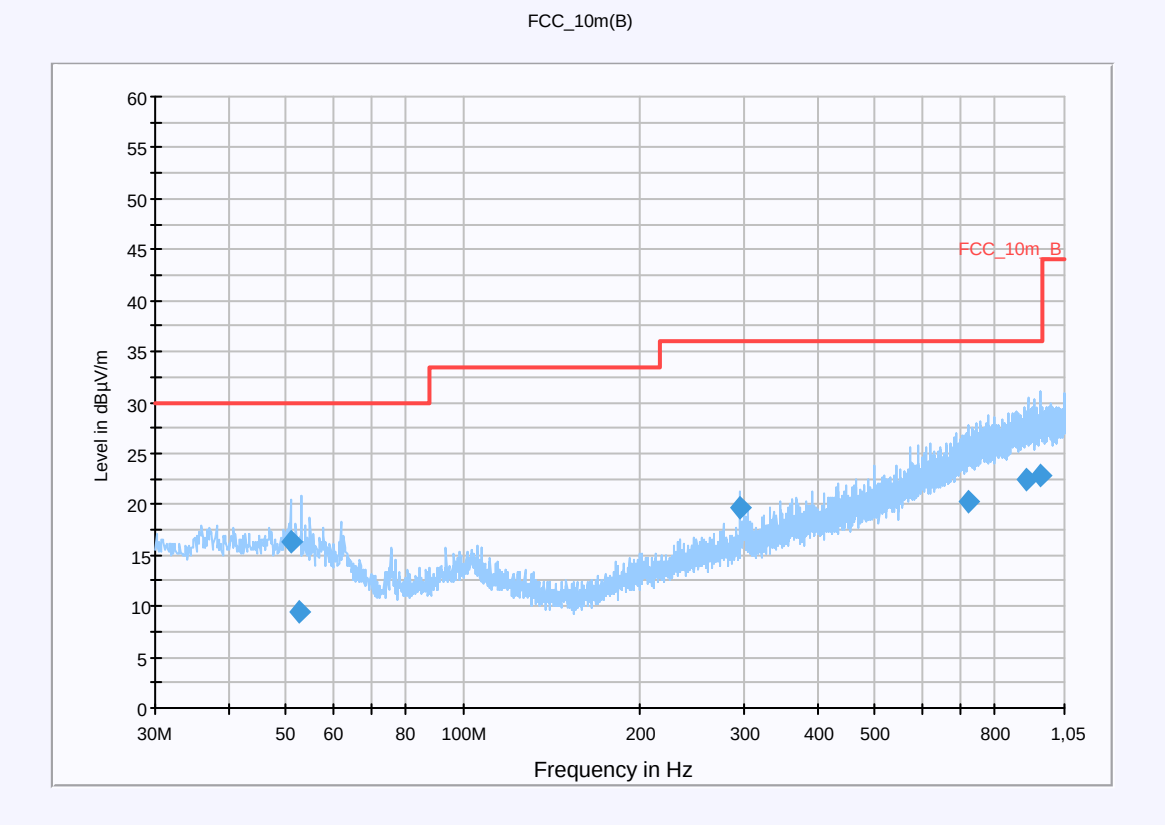
Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 94392602201011004
Test Description:	FCC part 15 C Class B @ 10 m
Operating Conditions:	WLAN b-mode; Continous Tx; Ch: 6 (2437 MHz)
Operator Name:	Lang
Comment:	

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dBµV/m

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1,05 GHz	QuasiPeak	120 kHz	15 s	Receiver



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
50.988600	16.3	15000.000	120.000	98.0	V	-1.0	13.3	13.7	30.0	
52.608900	9.4	15000.000	120.000	198.0	H	72.0	13.1	20.6	30.0	
295.765200	19.7	15000.000	120.000	342.0	V	278.0	14.3	16.3	36.0	
721.723650	20.3	15000.000	120.000	105.0	V	100.0	22.9	15.7	36.0	
907.964400	22.4	15000.000	120.000	400.0	V	48.0	25.2	13.6	36.0	
952.564800	22.9	15000.000	120.000	300.0	V	153.0	25.4	13.1	36.0	

Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]

	Subrange 1
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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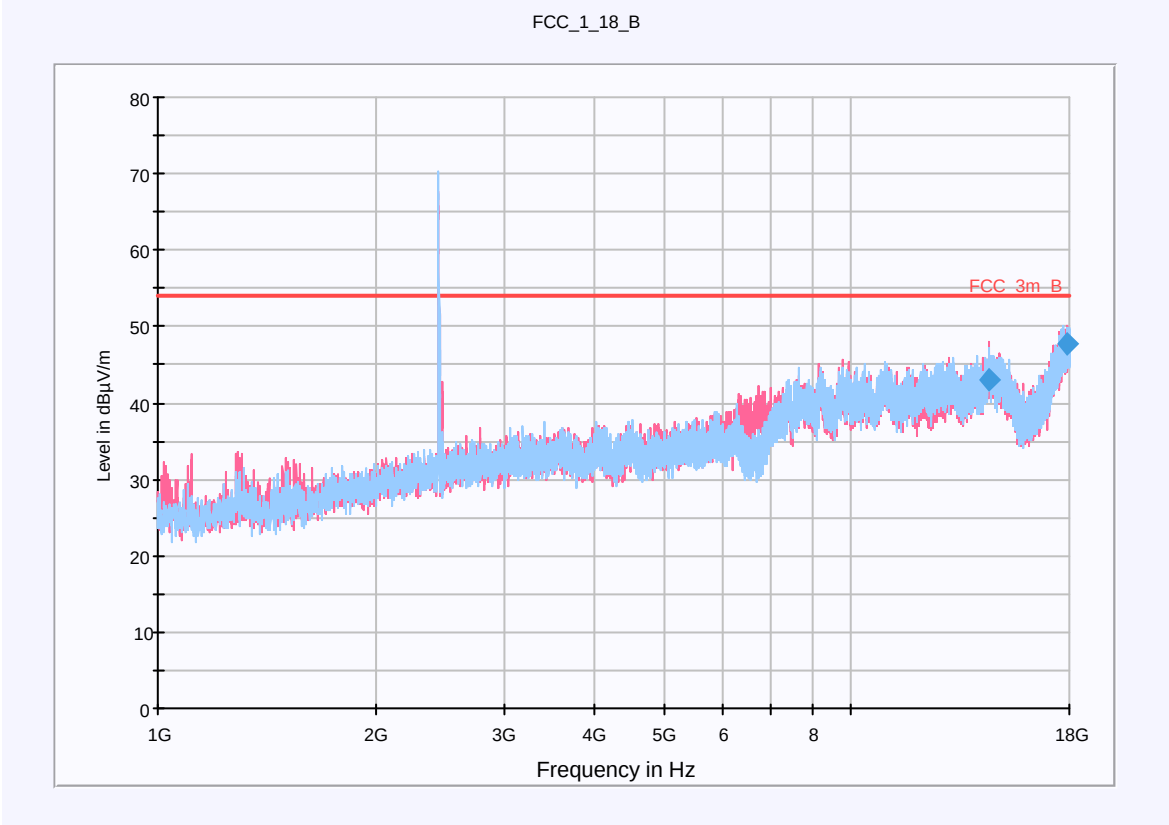
Plot 6: TX mode, mid channel – 2437 MHz, 1 GHz – 18 GHz, vertical & horizontal polarization

Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 943926022010110004
Test Description:	FCC part 15 C Class B @ 3m
Operating Conditions:	WLAN b-mode; Continous Tx; Ch: 6 (2437 MHz)
Operator Name:	Lang
Comment:	



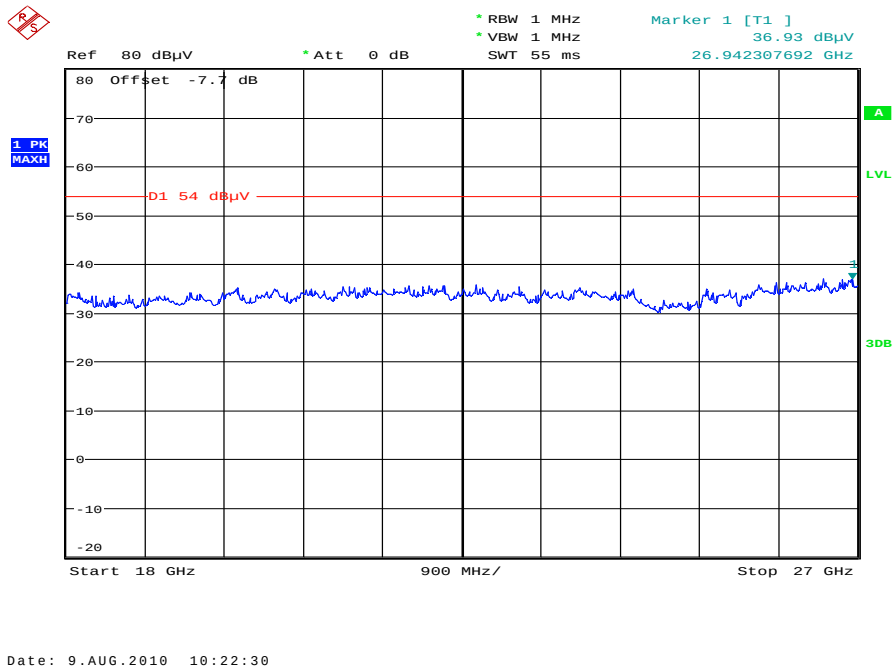
Final Result 1

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
13998.168750	43.1	1.000	1000.000	128.0	V	6.0	7.8	10.9	54.0	
17881.344500	47.8	1.000	1000.000	128.0	V	326.0	12.2	6.2	54.0	

Hardware Setup: **EMI radiated\FSU_1_18_FCC - [EMI radiated]**

Subrange 1	
Frequency Range:	1 GHz - 18 GHz
Receiver:	FSU 26 [FSU 26] @ GPIB0 (ADR 21), SN 200809/026, FW 4.41
Signal Path:	1_18_FCC FW 1.0
Antenna:	FCC_Horn Correction Table (vertical): EMCO 3115_EN Correction Table (horizontal): EMCO 3115_EN Correction Table: LNA + Cabel_FCC (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

Plot 7: TX mode, mid channel – 2437 MHz, 18 GHz – 27 GHz, vertical & horizontal polarization



Plot 8: TX mode, high channel – 2462 MHz, 30 MHz – 1GHz, vertical & horizontal polarization

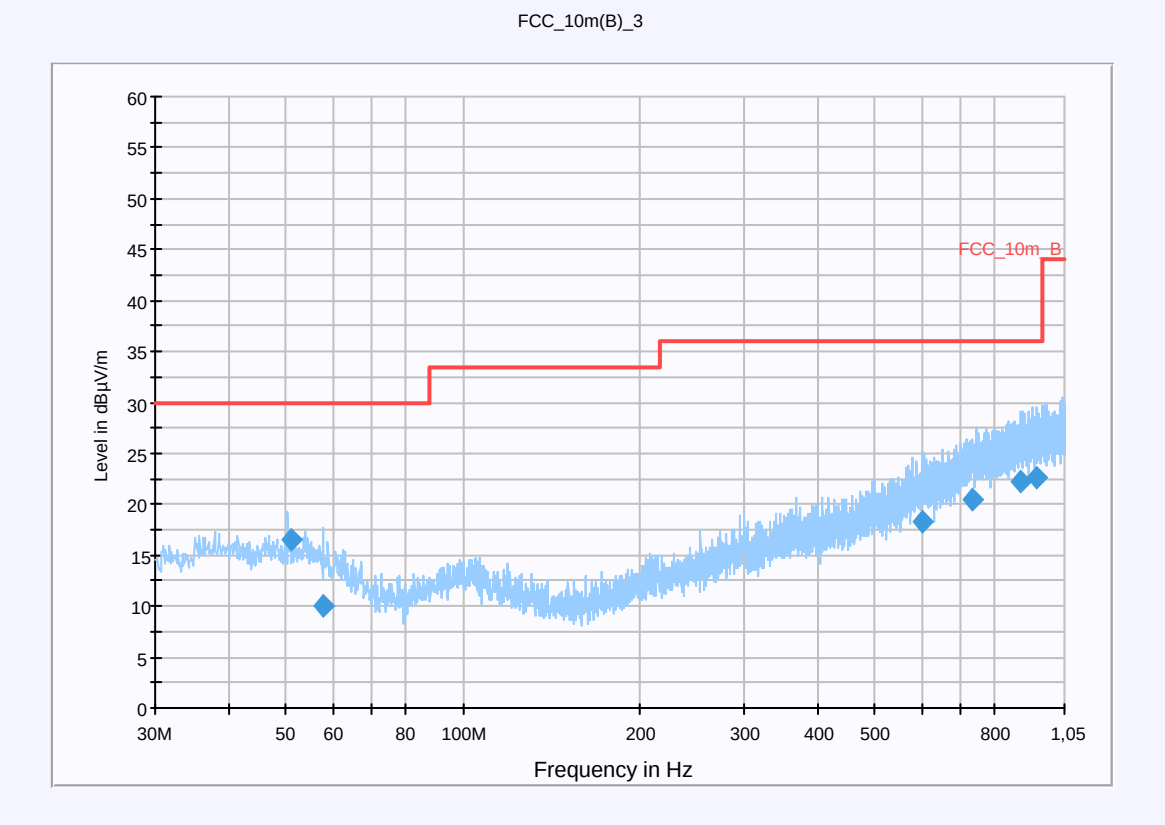
Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 94392602201011004
Test Description:	FCC part 15 C Class B @ 10 m
Operating Conditions:	WLAN b-mode; Continous Tx; Ch: 11 (2462 MHz)
Operator Name:	Lang
Comment:	

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dBµV/m

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1,05 GHz	QuasiPeak	120 kHz	15 s	Receiver



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
50.994750	16.5	15000.000	120.000	98.0	V	271.0	13.3	13.5	30.0	
58.053300	10.0	15000.000	120.000	220.0	V	325.0	12.1	20.0	30.0	
604.446450	18.3	15000.000	120.000	153.0	V	27.0	20.8	17.7	36.0	
731.847300	20.4	15000.000	120.000	220.0	H	67.0	23.2	15.6	36.0	
884.827050	22.2	15000.000	120.000	220.0	H	134.0	25.0	13.8	36.0	
940.151250	22.6	15000.000	120.000	220.0	H	223.0	25.3	13.4	36.0	

Hardware Setup: **EMI radiated\Electric Field (NOS) - [EMI radiated]**

	Subrange 1
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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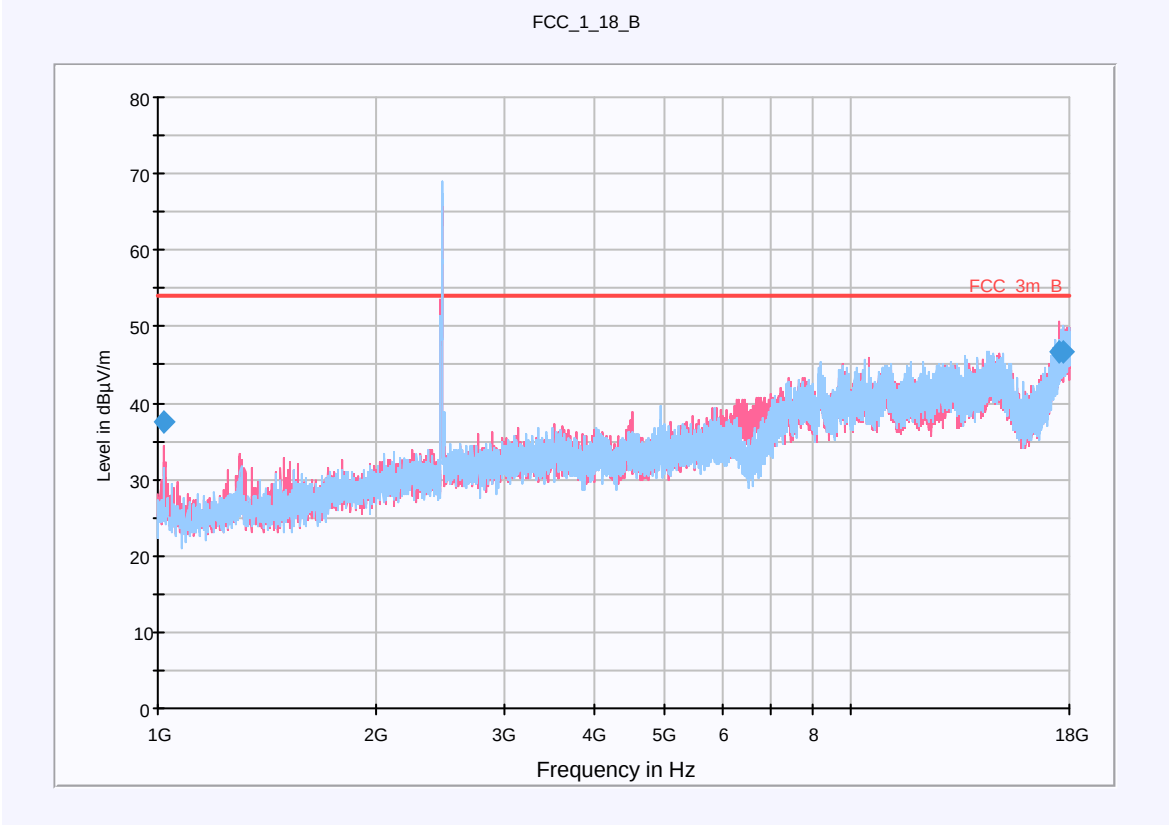
Plot 9: TX mode, high channel – 2462 MHz, 1 GHz – 18 GHz, vertical polarization

Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 943926022010110004
Test Description:	FCC part 15 C Class B @ 3m
Operating Conditions:	WLAN b-mode; Continous Tx; Ch: 11 (2462 MHz)
Operator Name:	Lang
Comment:	



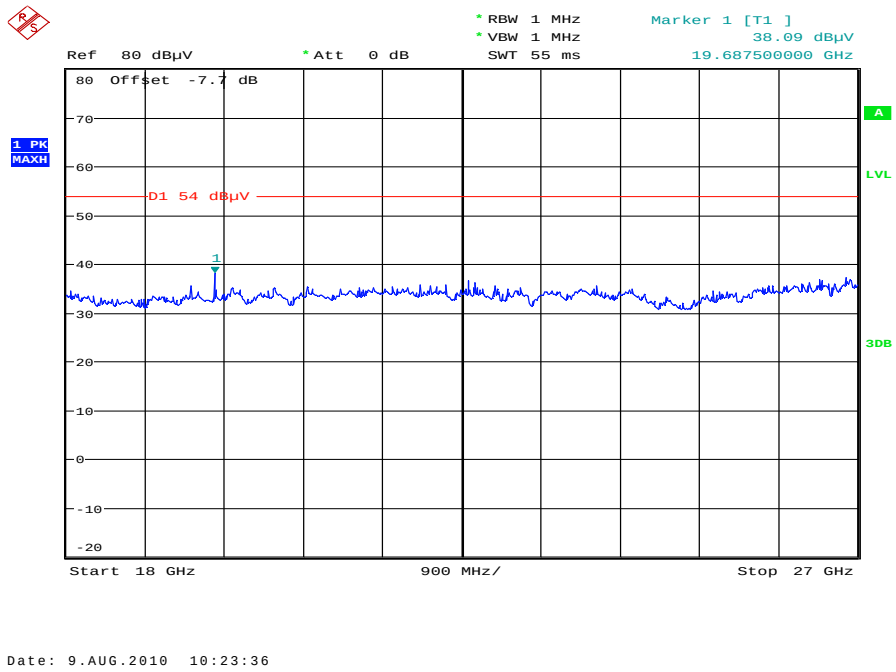
Final Result 1

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
1018.444000	37.6	1.000	1000.000	110.0	V	198.0	-14.6	16.4	54.0	
17473.526250	46.8	1.000	1000.000	128.0	V	353.0	11.1	7.2	54.0	
17617.328500	46.7	1.000	1000.000	128.0	V	289.0	11.6	7.3	54.0	

Hardware Setup: **EMI radiated\FSU_1_18_FCC - [EMI radiated]**

Subrange 1	
Frequency Range:	1 GHz - 18 GHz
Receiver:	FSU 26 [FSU 26] @ GPIB0 (ADR 21), SN 200809/026, FW 4.41
Signal Path:	1_18_FCC FW 1.0
Antenna:	FCC_Horn Correction Table (vertical): EMCO 3115_EN Correction Table (horizontal): EMCO 3115_EN Correction Table: LNA + Cabel_FCC (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

Plot 10: TX mode, high channel – 2462 MHz, 18 GHz – 27 GHz, vertical & horizontal polarization



G –mode:

Plot 1: TX mode, low channel – 2412 MHz, 30 MHz – 1GHz, vertical & horizontal polarization

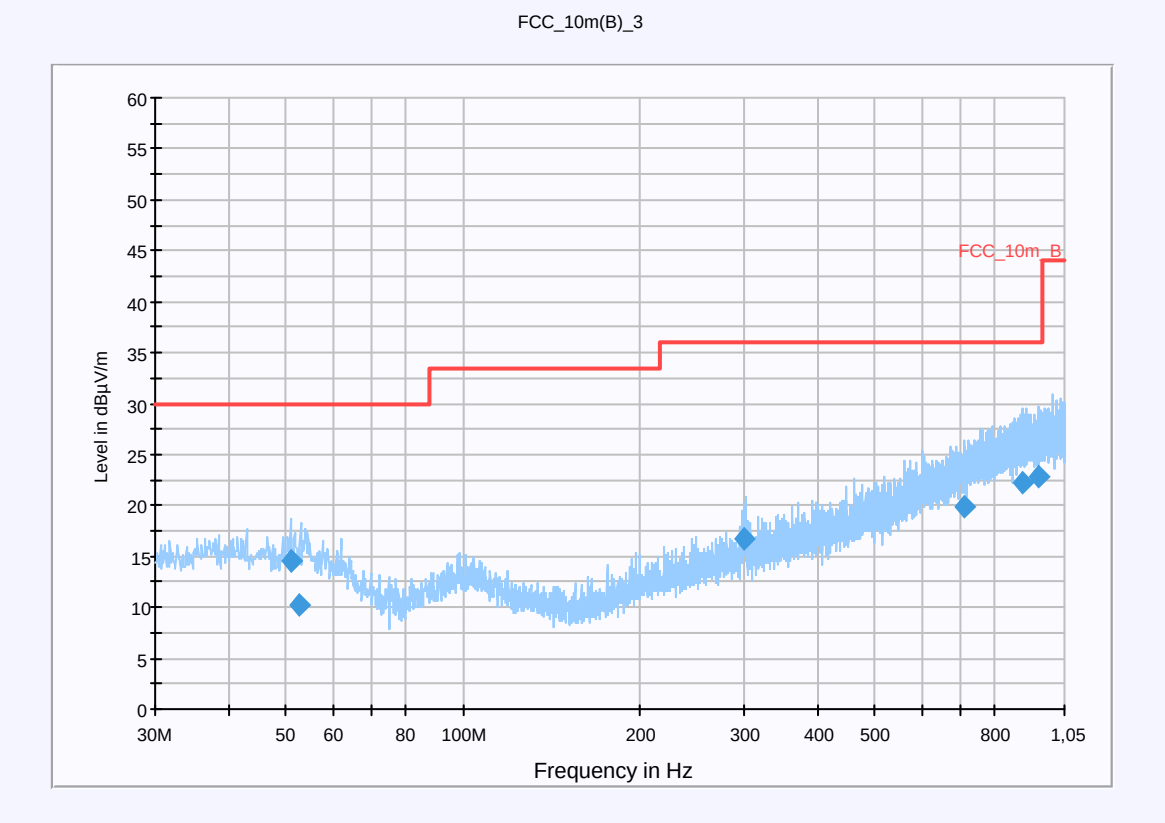
Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 943926022010110004
Test Description:	FCC part 15 C Class B @ 10 m
Operating Conditions:	WLAN g-mode; Continous Tx; Ch: 1 (2412 MHz)
Operator Name:	Lang
Comment:	

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dBµV/m

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1,05 GHz	QuasiPeak	120 kHz	15 s	Receiver



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
50.961600	14.6	15000.000	120.000	120.0	V	20.0	13.3	15.4	30.0	
52.695900	10.2	15000.000	120.000	220.0	V	52.0	13.1	19.8	30.0	
299.754150	16.6	15000.000	120.000	182.0	V	221.0	14.4	19.4	36.0	
710.535000	19.9	15000.000	120.000	98.0	H	9.0	22.7	16.1	36.0	
887.542950	22.3	15000.000	120.000	220.0	H	63.0	25.0	13.7	36.0	
951.760050	22.8	15000.000	120.000	220.0	V	131.0	25.4	13.2	36.0	

Hardware Setup: **EMI radiated\Electric Field (NOS) - [EMI radiated]**

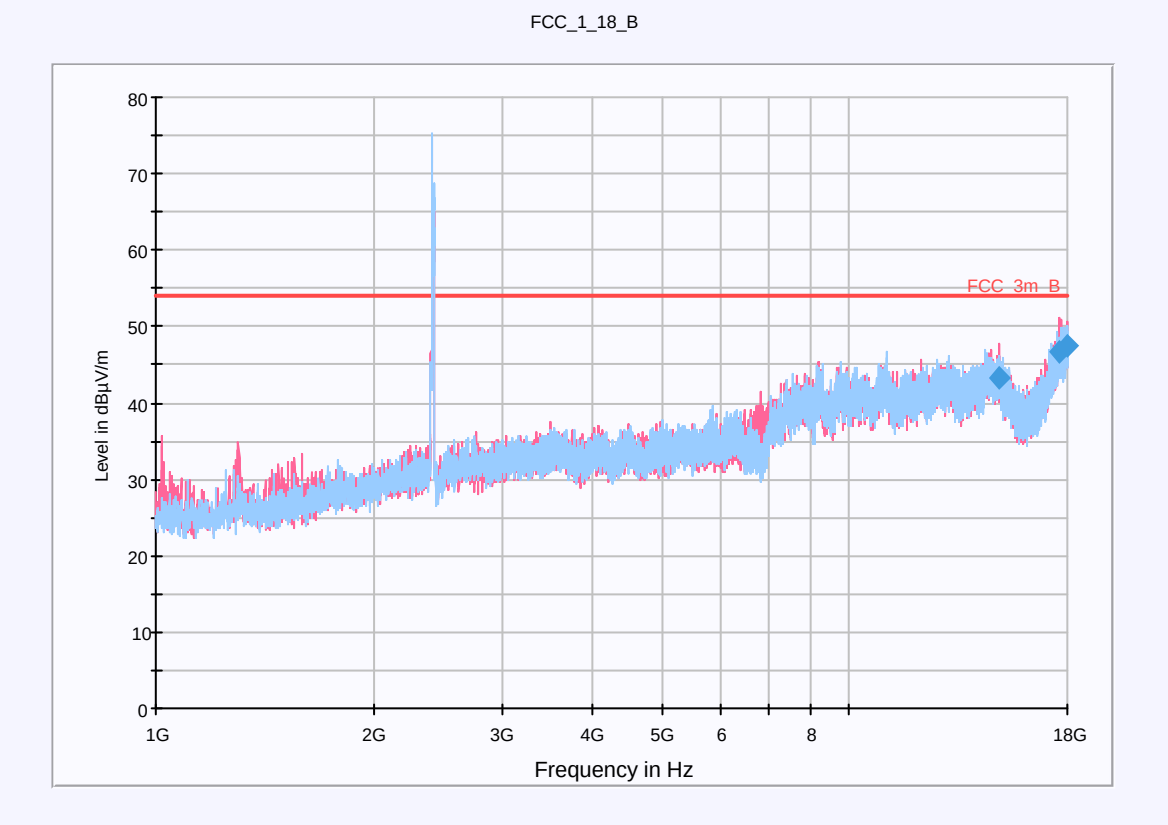
	Subrange 1
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 8.10.00

Plot 2: TX mode, low channel – 2412 MHz, 1 GHz – 18GHz, vertical & horizontal polarization

Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 943926022010110004
Test Description:	FCC part 15 C Class B @ 3m
Operating Conditions:	WLAN g-mode; Continous Tx; Ch: 1 (2412 MHz)
Operator Name:	Lang
Comment:	



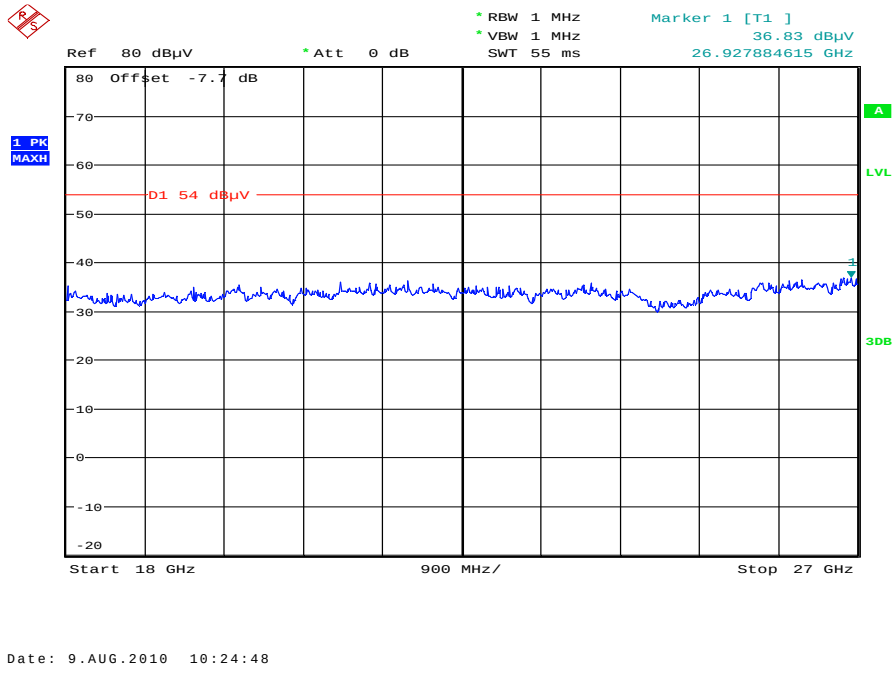
Final Result 1

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
14517.782750	43.2	1.000	1000.000	128.0	V	290.0	7.2	10.8	54.0	
17538.114750	46.7	1.000	1000.000	128.0	V	45.0	11.4	7.3	54.0	
...	...	...	...	...	...	...	...	...	...	...

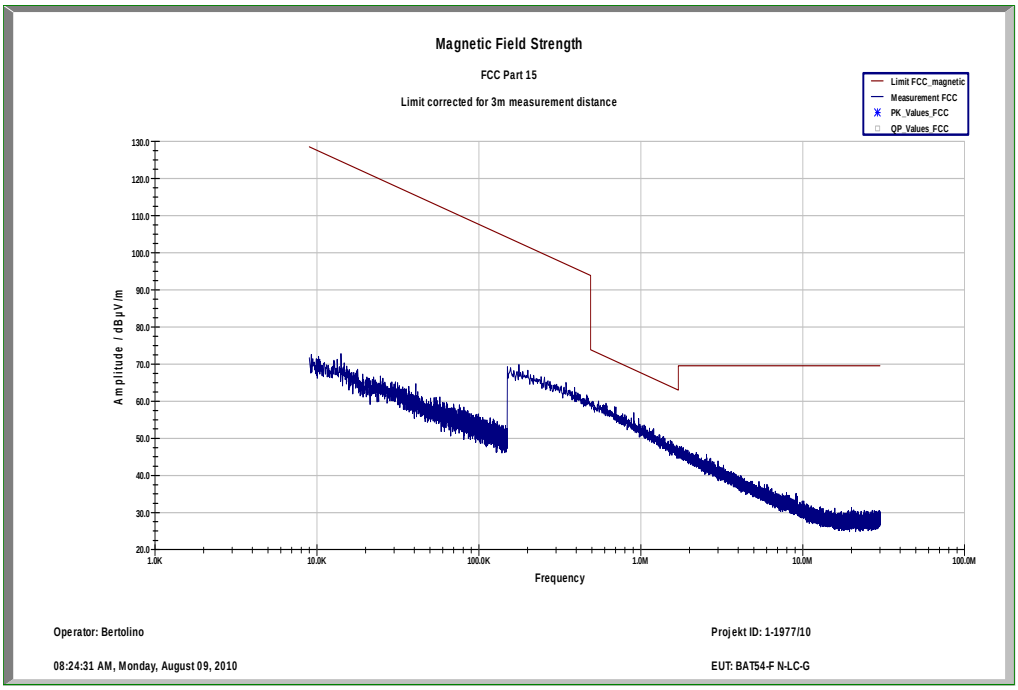
Hardware Setup: **EMI radiated\FSU_1_18_FCC - [EMI radiated]**

Subrange 1	
Frequency Range:	1 GHz - 18 GHz
Receiver:	FSU 26 [FSU 26] @ GPIB0 (ADR 21), SN 200809/026, FW 4.41
Signal Path:	1_18_FCC FW 1.0
Antenna:	FCC_Horn Correction Table (vertical): EMCO 3115_EN Correction Table (horizontal): EMCO 3115_EN Correction Table: LNA + Cabel_FCC (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

Plot 3: TX mode, low channel – 2412 MHz, 18 GHz – 27 GHz, vertical & horizontal polarization



Plot 4: TX mode, mid channel – 2437 MHz, 9 kHz – 30 MHz, magnetic



Plot 5: TX mode, mid channel – 2437 MHz, 30 MHz – 1GHz, vertical & horizontal polarization

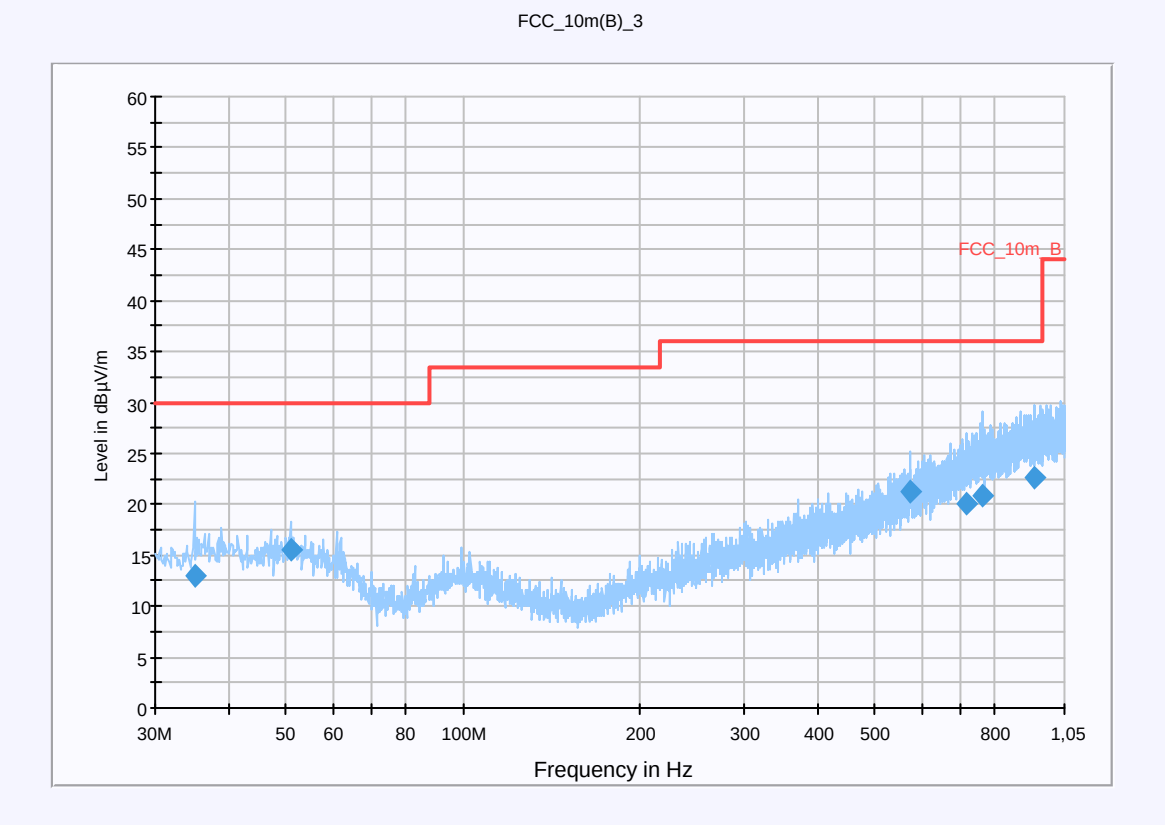
Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 94392602201011004
Test Description:	FCC part 15 C Class B @ 10 m
Operating Conditions:	WLAN g-mode; Continous Tx; Ch: 6 (2437 MHz)
Operator Name:	Lang
Comment:	

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dBµV/m

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1,05 GHz	QuasiPeak	120 kHz	15 s	Receiver



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
35.000400	13.0	15000.000	120.000	120.0	V	99.0	13.0	17.0	30.0	
50.982900	15.5	15000.000	120.000	175.0	V	30.0	13.3	14.5	30.0	
574.580850	21.3	15000.000	120.000	98.0	V	98.0	20.1	14.7	36.0	
713.260950	20.0	15000.000	120.000	220.0	H	170.0	22.7	16.0	36.0	
762.806700	20.9	15000.000	120.000	220.0	V	177.0	23.7	15.1	36.0	
933.804750	22.6	15000.000	120.000	149.0	H	118.0	25.3	13.4	36.0	

Hardware Setup: **EMI radiated\Electric Field (NOS) - [EMI radiated]**

	Subrange 1
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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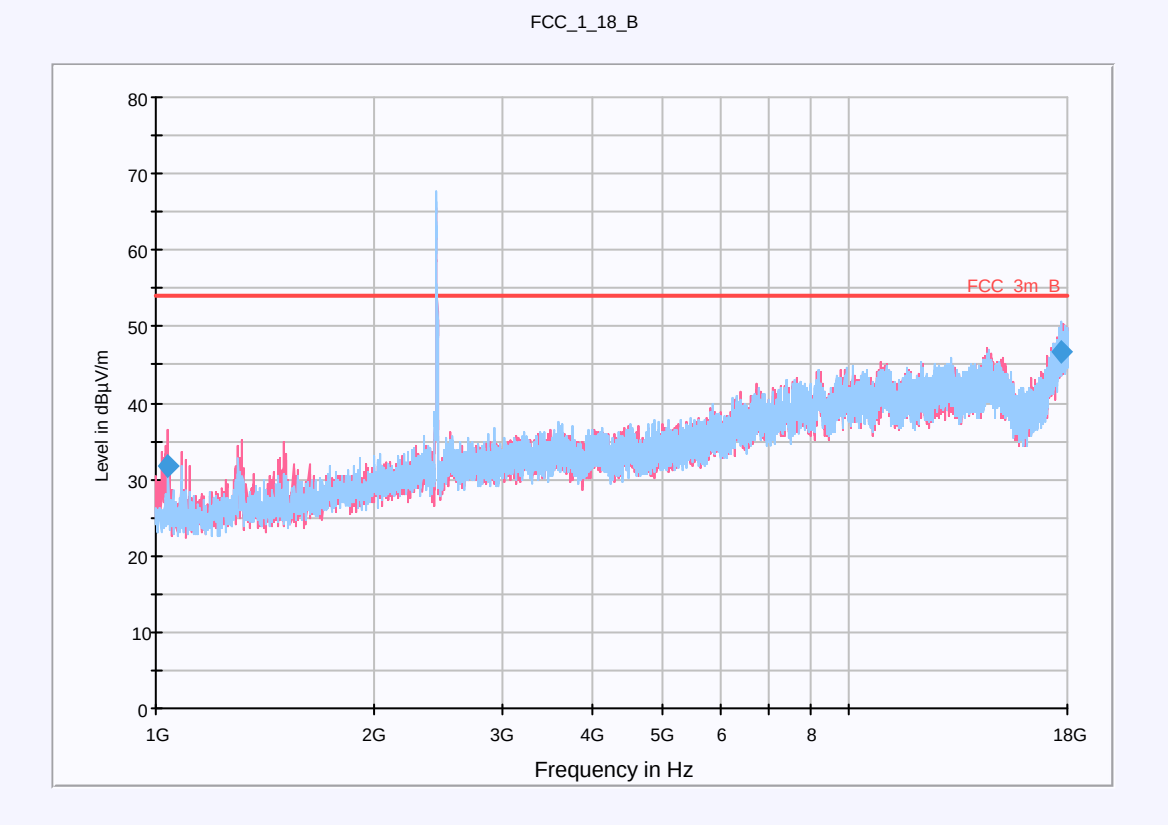
Plot 6: TX mode, mid channel – 2437 MHz, 1 GHz – 18 GHz, vertical & horizontal polarization

Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 943926022010110004
Test Description:	FCC part 15 C Class B @ 3m
Operating Conditions:	WLAN g-mode; Continous Tx; Ch: 6 (2437 MHz)
Operator Name:	Lang
Comment:	



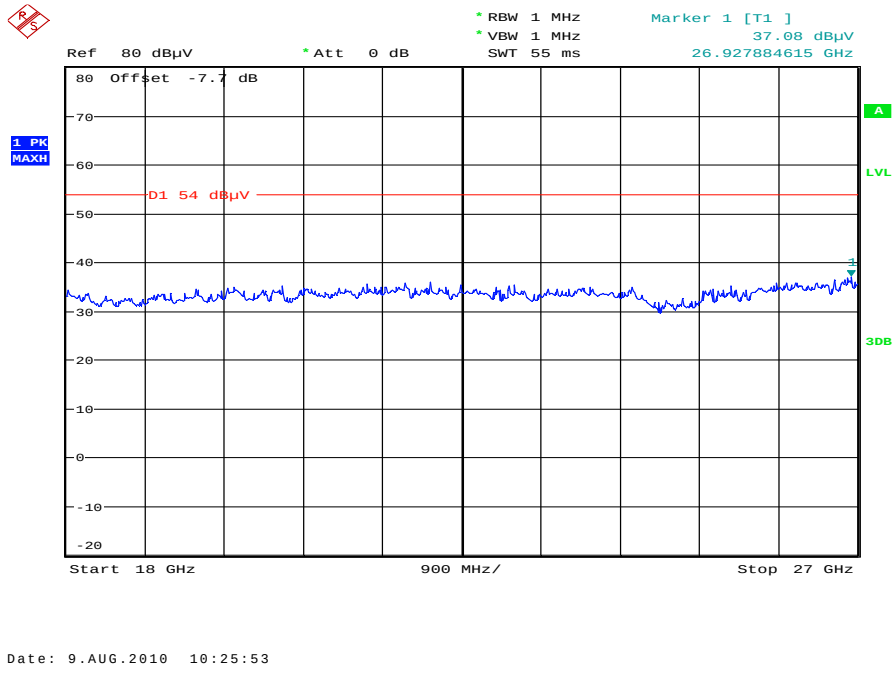
Final Result 1

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
1040.300500	31.8	1.000	1000.000	98.0	V	-4.0	-14.5	22.2	54.0	
17615.166500	46.6	1.000	1000.000	98.0	H	66.0	11.6	7.4	54.0	

Hardware Setup: **EMI radiated\FSU_1_18_FCC - [EMI radiated]**

Subrange 1	
Frequency Range:	1 GHz - 18 GHz
Receiver:	FSU 26 [FSU 26] @ GPIB0 (ADR 21), SN 200809/026, FW 4.41
Signal Path:	1_18_FCC FW 1.0
Antenna:	FCC_Horn Correction Table (vertical): EMCO 3115_EN Correction Table (horizontal): EMCO 3115_EN Correction Table: LNA + Cabel_FCC (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

Plot 7: TX mode, mid channel – 2437 MHz, 18 GHz – 27 GHz, vertical & horizontal polarization



Plot 8: TX mode, high channel – 2462 MHz, 30 MHz – 1GHz, vertical & horizontal polarization

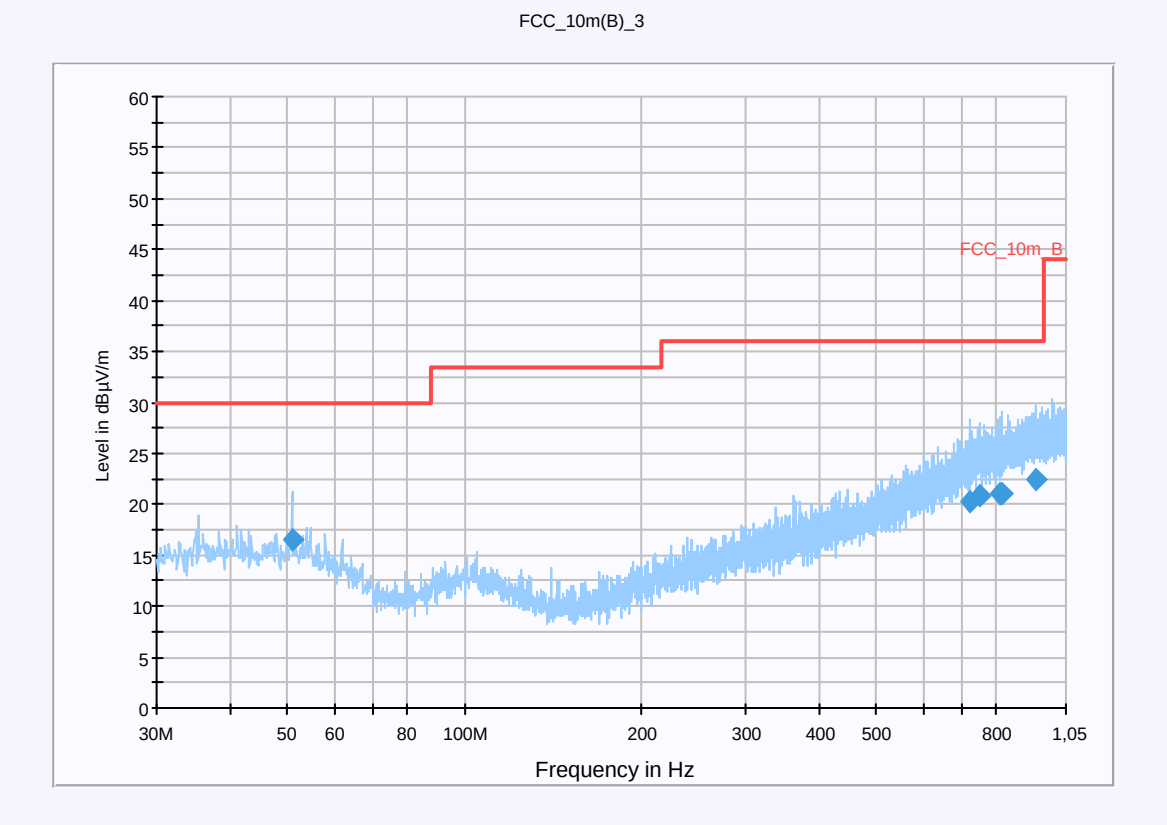
Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 943926022010110004
Test Description:	FCC part 15 C Class B @ 10 m
Operating Conditions:	WLAN g-mode; Continous Tx; Ch: 11 (2462 MHz)
Operator Name:	Lang
Comment:	

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dBµV/m

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1,05 GHz	QuasiPeak	120 kHz	15 s	Receiver



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
50.995950	16.5	15000.000	120.000	98.0	V	187.0	13.3	13.5	30.0	
720.436950	20.2	15000.000	120.000	220.0	H	43.0	22.9	15.8	36.0	
749.617350	20.8	15000.000	120.000	115.0	V	75.0	23.6	15.2	36.0	
810.188400	21.0	15000.000	120.000	220.0	H	308.0	24.0	15.0	36.0	
817.128150	21.1	15000.000	120.000	145.0	H	194.0	24.1	14.9	36.0	
930.414900	22.4	15000.000	120.000	98.0	V	52.0	25.3	13.6	36.0	

Hardware Setup: **EMI radiated\Electric Field (NOS) - [EMI radiated]**

	Subrange 1
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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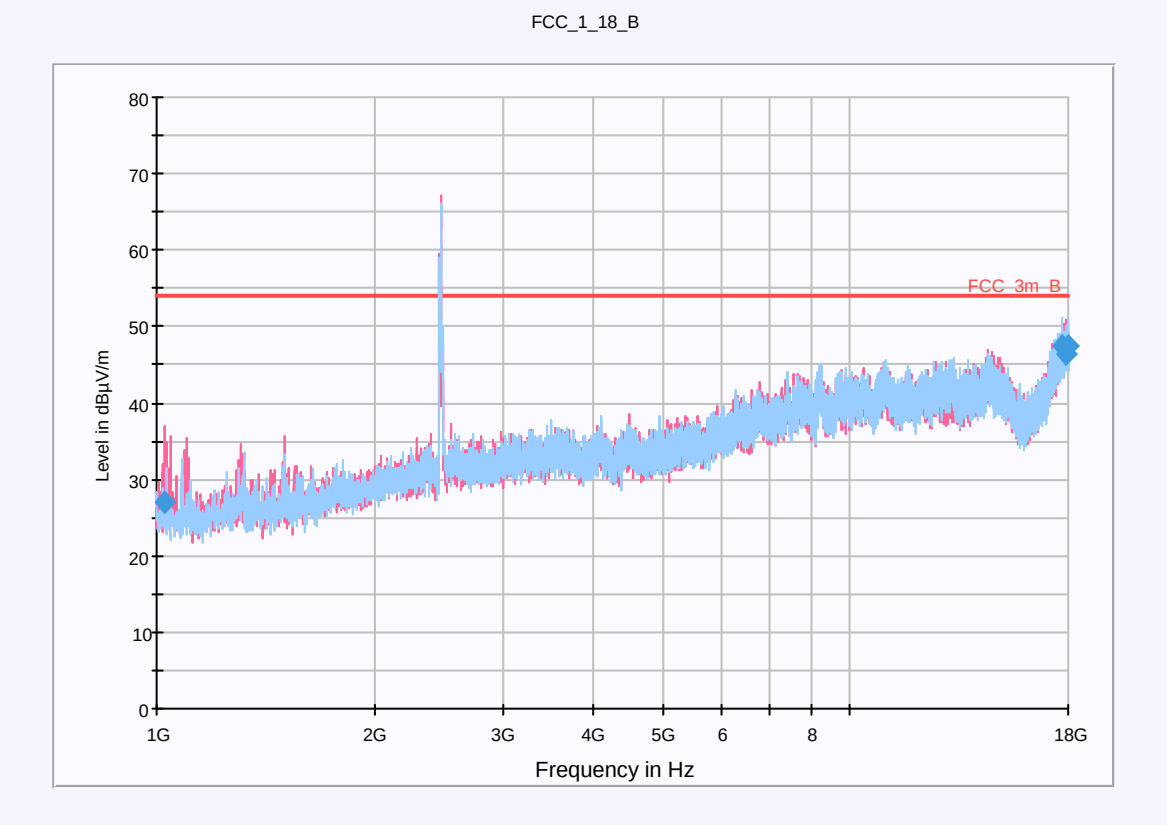
Plot 9: TX mode, high channel – 2462 MHz, 1 GHz – 18 GHz, vertical polarization

Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 943926022010110004
Test Description:	FCC part 15 C Class B @ 3m
Operating Conditions:	WLAN g-mode; Continous TX; Ch: 11 (2462 MHz)
Operator Name:	Lang
Comment:	



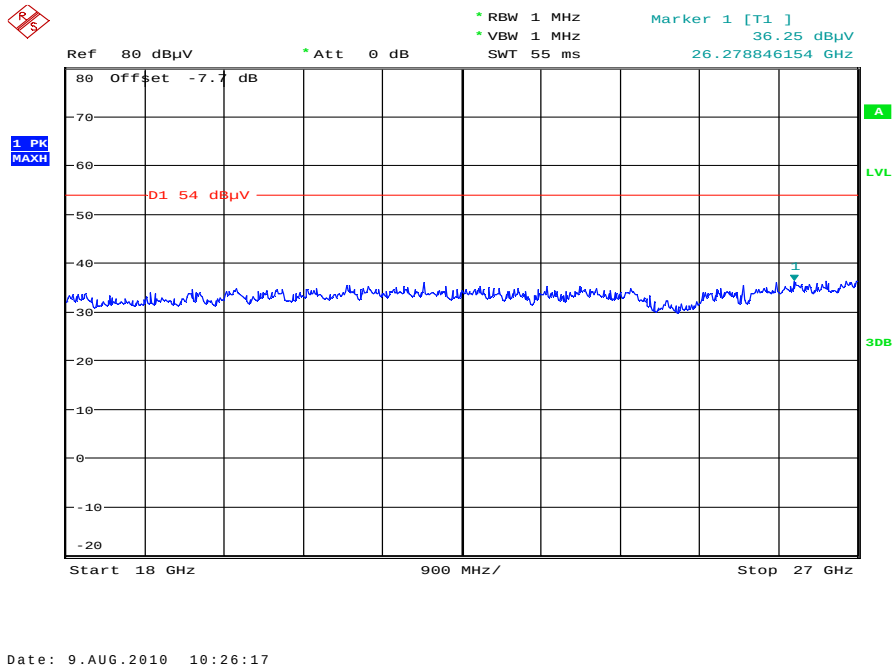
Final Result 1

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
1025.455000	27.1	1.000	1000.000	128.0	V	-1.0	-14.5	26.9	54.0	
17616.859750	47.6	1.000	1000.000	128.0	H	163.0	11.6	6.4	54.0	
17929.773250	46.5	1.000	1000.000	98.0	V	38.0	12.3	7.5	54.0	
17962.629000	47.4	1.000	1000.000	128.0	H	251.0	12.4	6.6	54.0	

Hardware Setup: **EMI radiated\FSU_1_18_FCC - [EMI radiated]**

Subrange 1	
Frequency Range:	1 GHz - 18 GHz
Receiver:	FSU 26 [FSU 26] @ GPIB0 (ADR 21), SN 200809/026, FW 4.41
Signal Path:	1_18_FCC FW 1.0
Antenna:	FCC_Horn Correction Table (vertical): EMCO 3115_EN Correction Table (horizontal): EMCO 3115_EN Correction Table: LNA + Cabel_FCC (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

Plot 10: TX mode, high channel – 2462 MHz, 18 GHz – 27 GHz, vertical & horizontal polarization



9.10 RX Spurious Emissions Radiated

Description:

Measurement of the radiated spurious emissions in idle/receive mode. The results are valid for both modes.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	Sweep: 100 kHz Remeasurement: 10 Hz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Span:	30 MHz to 25 GHz
Trace-Mode:	Max Hold

Limits:

FCC		IC
CFR Part 15.109		RSS Gen, Issue 2, 4.10
RX Spurious Emissions Radiated		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

Result: **Also see plots**

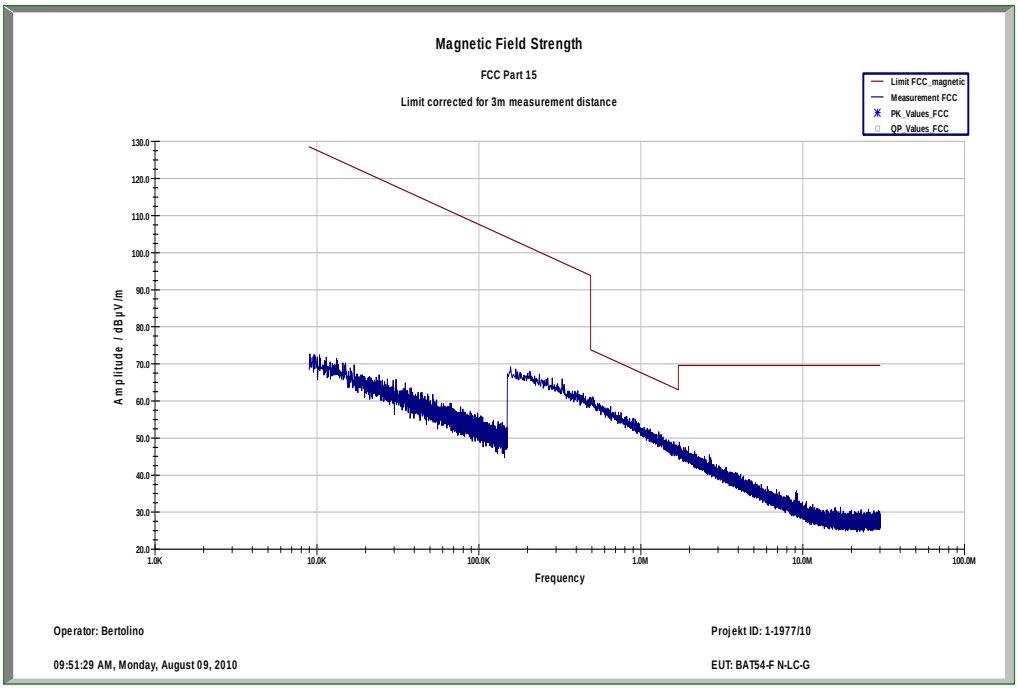
RX Spurious Emissions Radiated [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
Please take a look at the table below the plot!		
Measurement uncertainty	± 3 dB	

Result: **The result of the measurement is passed.**

Antenna: BAT-ANT_N_LC-G-50m-IP65

The measurements are valid for both DSSS and OFDM mode!

Plot 1: RX mode, 9 kHz – 30 MHz, magnetic



Plot 2: RX mode, 30 MHz – 1GHz, vertical & horizontal polarization

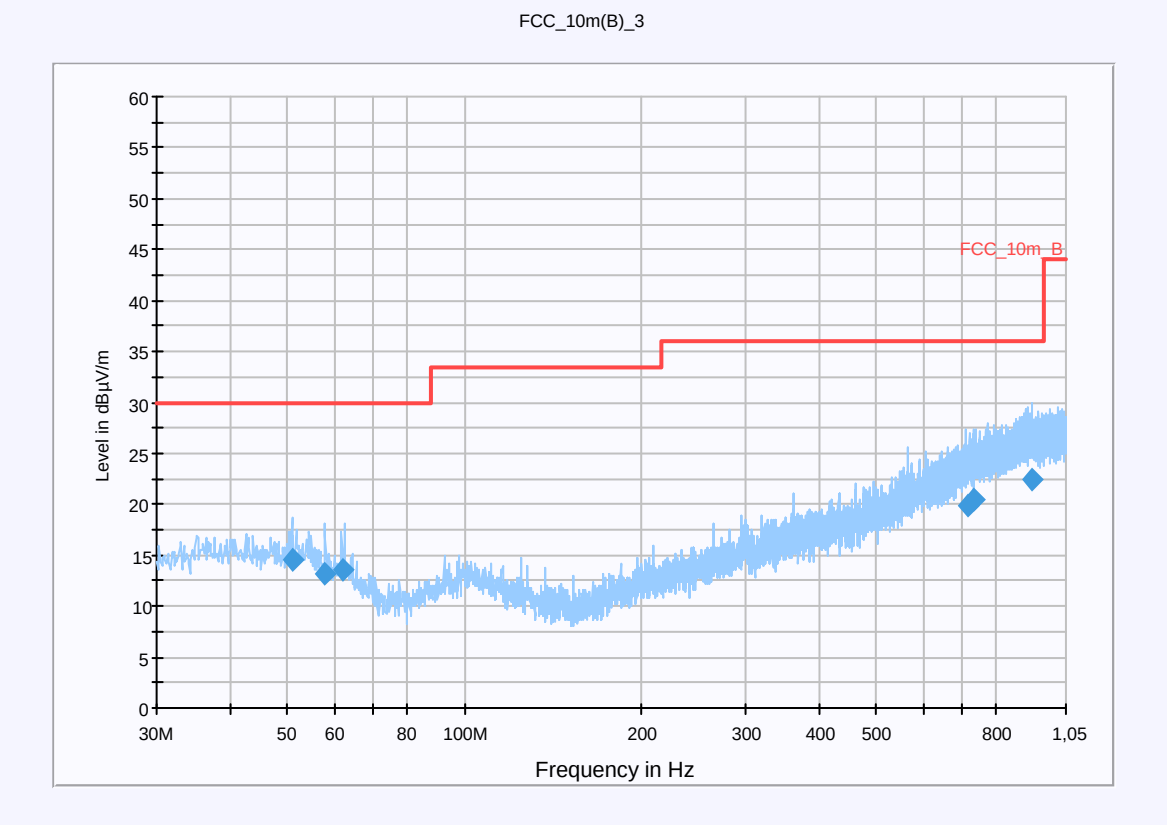
Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 943926022010110004
Test Description:	FCC part 15 C Class B @ 10 m
Operating Conditions:	WLAN; Rx-mode
Operator Name:	Lang
Comment:	

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Level Unit:	dBµV/m

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
30 MHz - 1,05 GHz	QuasiPeak	120 kHz	15 s	Receiver



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
50.961900	14.5	15000.000	120.000	141.0	V	160.0	13.3	15.5	30.0	
57.979500	13.2	15000.000	120.000	166.0	V	70.0	12.1	16.8	30.0	
61.994700	13.6	15000.000	120.000	166.0	V	142.0	11.1	16.4	30.0	
712.689600	20.0	15000.000	120.000	220.0	V	248.0	22.7	16.0	36.0	
733.823100	20.5	15000.000	120.000	220.0	H	112.0	23.2	15.5	36.0	
919.704750	22.5	15000.000	120.000	220.0	V	236.0	25.3	13.5	36.0	

Hardware Setup: **EMI radiated\Electric Field (NOS) - [EMI radiated]**

	Subrange 1
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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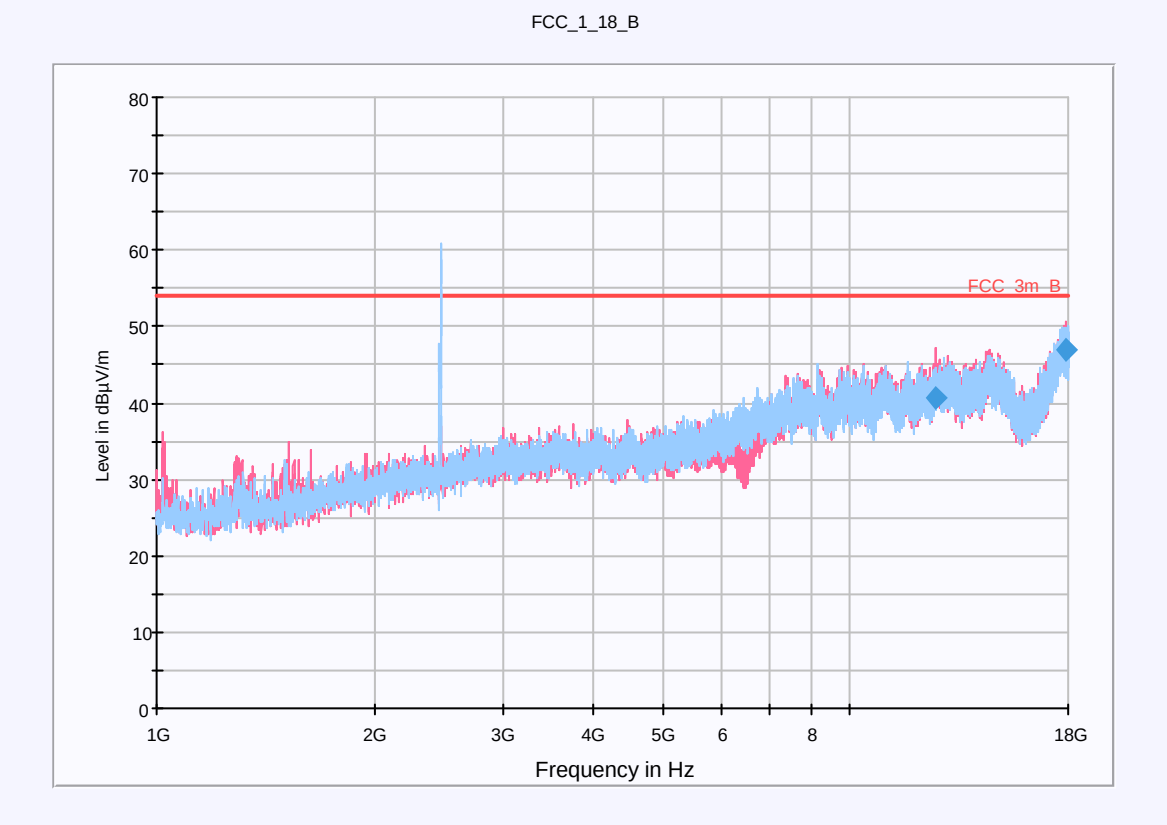
Plot 3: RX mode, 1 GHz – 18 GHz, vertical & horizontal polarization

Common Information

EUT:	BAT-ANT-N-LC-G-50m/100m-IP6 + BAT54-F
Serial Number:	prototype + 943926022010110004
Test Description:	FCC part 15 C Class B @ 3m
Operating Conditions:	WLAN; Rx
Operator Name:	Lang
Comment:	



Final Result 1

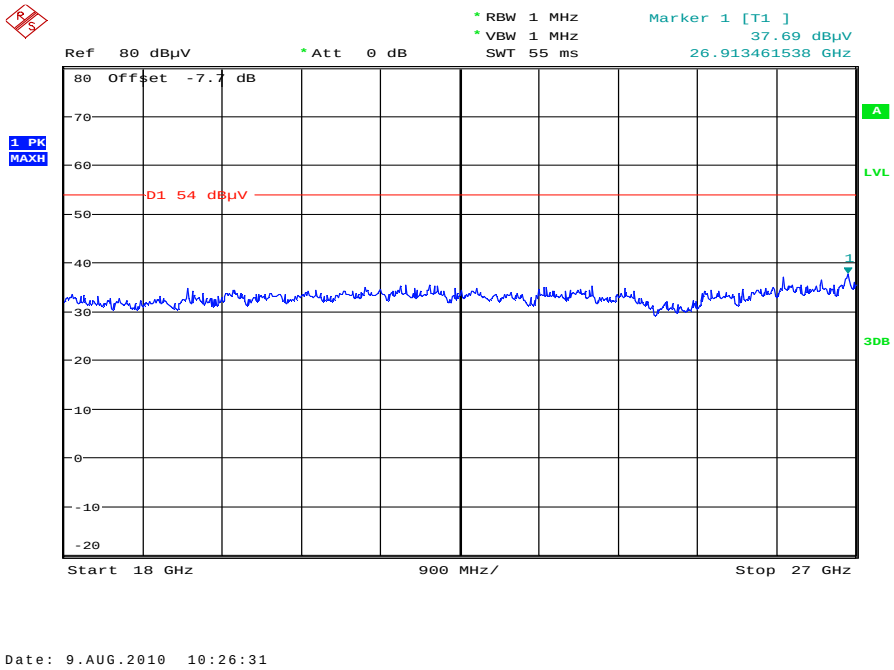
Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
11819.172750	40.6	1.000	1000.000	130.0	V	230.0	5.0	13.4	54.0	
17921.013500	46.8	1.000	1000.000	130.0	V	-4.0	12.3	7.2	54.0	

The detected peak is not a spurious emission – it's WLAN beacon only!

Hardware Setup: **EMI radiated\FSU_1_18_FCC - [EMI radiated]**

Subrange 1	
Frequency Range:	1 GHz - 18 GHz
Receiver:	FSU 26 [FSU 26] @ GPIB0 (ADR 21), SN 200809/026, FW 4.41
Signal Path:	1_18_FCC FW 1.0
Antenna:	FCC_Horn Correction Table (vertical): EMCO 3115_EN Correction Table (horizontal): EMCO 3115_EN Correction Table: LNA + Cabel_FCC (0909)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

Plot 4: RX mode, 18 GHz – 27 GHz, vertical & horizontal polarization



9.11 TX Spurious Emissions Conducted < 30 MHz

Not performed!
Delta tests only!

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 6. This measurement is repeated for DSSS and OFDM modulation. If critical peaks are found channel 1 and channel 11 will be measured too. The measurement is performed with the data rate producing the highest output power. Both power lines, phase and neutral line, are measured. Found peaks are remeasured with average and quasi peak detection to show compliance to the limits.

Measurement:

Measurement parameter	
Detector:	Peak - Quasi Peak / Average
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold

Limits:

FCC		IC
CFR Part 15.107(a)		-
TX Spurious Emissions Conducted < 30 MHz		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Result: **Also see plots**

TX Spurious Emissions Conducted < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
-/-		
Measurement uncertainty	± 3 dB	

Result: **-/-**

10 Test equipment and ancillaries used for tests

In order to simplify the identification of the equipment used at each specific test, each item of test equipment and ancillaries are provided with an identifier or number in the equipment list below.

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

No.	Labor / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kal. Art	Last Calibration	Next Calibration
1	45	Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368	g		
2	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580	k	06.01.2009	06.01.2011
3	n. a.	software	SPS_PHE 1.4f	Spitzberger & Spieß	B5981; 5D1081;B5979	300000210	ne		
4	n. a.	EMI Test Receiver	ESCI 1166.5950.03	R&S	100083	300003312	k	08.01.2010	08.01.2012
5	n. a.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	k	01.06.2009	01.06.2011
6	n. a.	Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379	ev		
7	n. a.	Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745	izw		
8	n. a.	Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746	izw		
9	n. a.	Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747	izw		
10	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	01.04.2010	01.04.2012
11	n. a.	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	08.01.2010	08.01.2012
12	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2818A03450	300001040	Ve	08.01.2009	08.01.2012
13	n. a.	PowerAttenuator	8325	Byrd	1530	300001595			
14	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vlKl!	05.03.2009	05.03.2011
15	n. a.	Active Loop Antenna	6502	EMCO	2210	300001015	ne		
16	n. a.	Anechoic chamber		MWB	87400/02	300000996			
17	Spec.A. 2_2e	System rack for EMI measurement solution	85900	HP I.V.	*	300000222	ne		
18	9	Artificial Mains 9 kHz to 30 MHz, 4 x 25 Ampere	ESH3-Z5	R&S	828576/020	300001210	Ve	06.01.2010	06.01.2012
19	n. a.	Relais Matrix	3488A	HP Meßtechnik	2719A15013	300001156	ne		
20	n. a.	Relais Matrix	PSU	R&S	890167/024	300001168	ne		
21	n. a.	Isolating Transformer	RT5A	Grundig	9242	300001263	ne		
22	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
23	n. a.	Switch / Control Unit	3488A	HP	2605e08770	300001443	ne		
24	n. a.	Band Reject filter	WRCG1855/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		

25	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
26	n. a.	TILE-Software Emission	Quantum Change, Modell TILE-ICS/FULL	EMCO	none	300003451	ne		
27	n. a.	Highpass Filter	WHKX2.9/18G-12SS	Wainwright	1	300003492	ev		
28	n. a.	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev		
29	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
30	n. a.	PSA Spectrum Analyzer 3 Hz - 26.5 GHz	E4440A	Agilent Technologies	MY48250080	300003812	k		
31	n. a.	MXG Microwave Analog Signal Generator	N5183A	Agilent Technologies	MY47420220	300003813	k		
32	n. a.	RF Filter Section 9kHz - 1GHz	N9039A	Agilent Technologies	MY48260003	300003825	vlKl!		
33	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlKl!	17.12.2008	17.12.2010
34	CR 79	Std. Gain Horn Antenna 26.5-40.0 GHz	V637	Narda	7911	300001751	ne		
35	19	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	Ve	30.06.2008	30.06.2010
36	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda		300000787	ne		
37	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda		300002442	ne		
38	n. a.	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	ve	01.07.2010	01.07.2012

Annex A Photographs of the Test Set-up

Photo documentation: BAT-ANT_N_LC-G-50m-IP65

Photo 1:

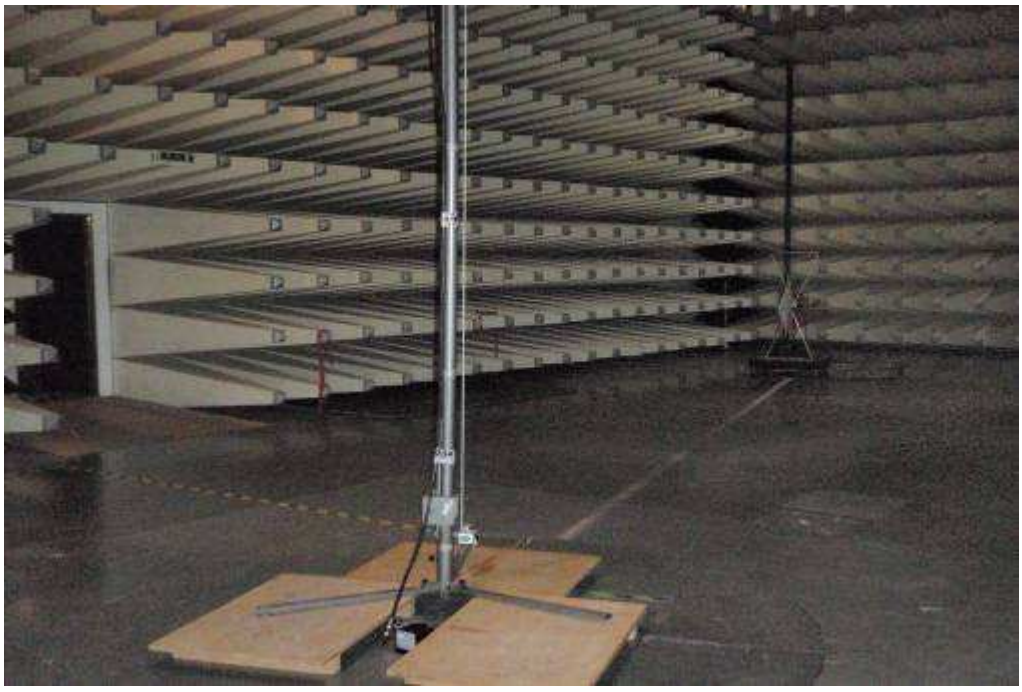


Photo 2:

Annex B External Photographs of the EUT

Photo documentation:

Photo 1:

Photo 2:

Photo 3:

Photo 4:

Photo 5:

Photo 6:

Photo 7:

Photo 8:

Photo 9:

Photo 10:

Photo 11:

Photo 12:

Annex C Internal Photographs of the EUT

Photo documentation:

Photo 1:

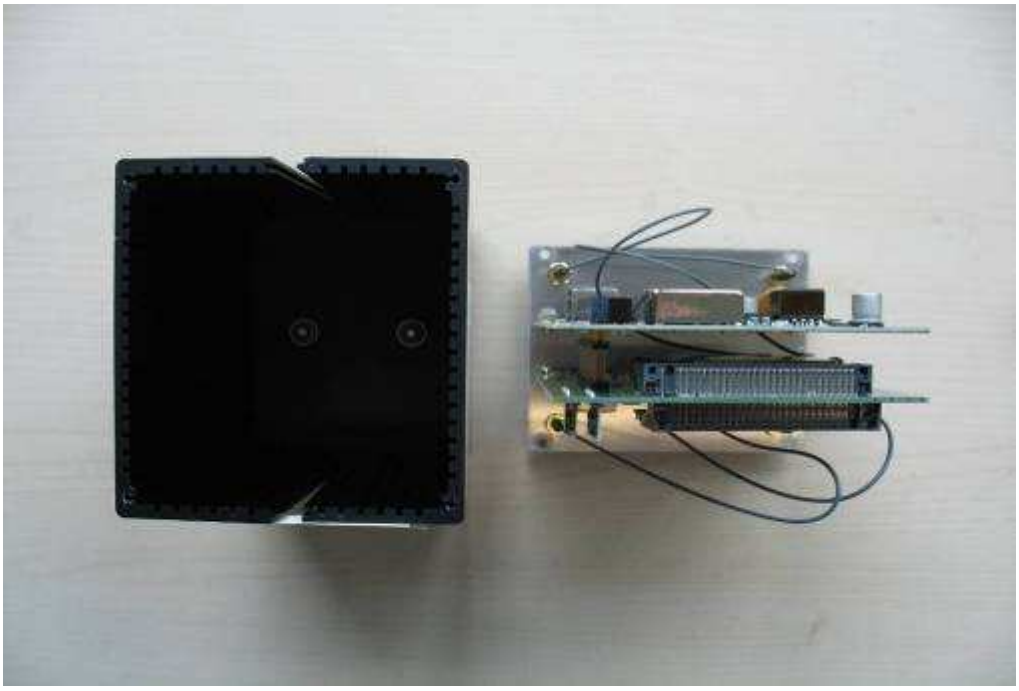
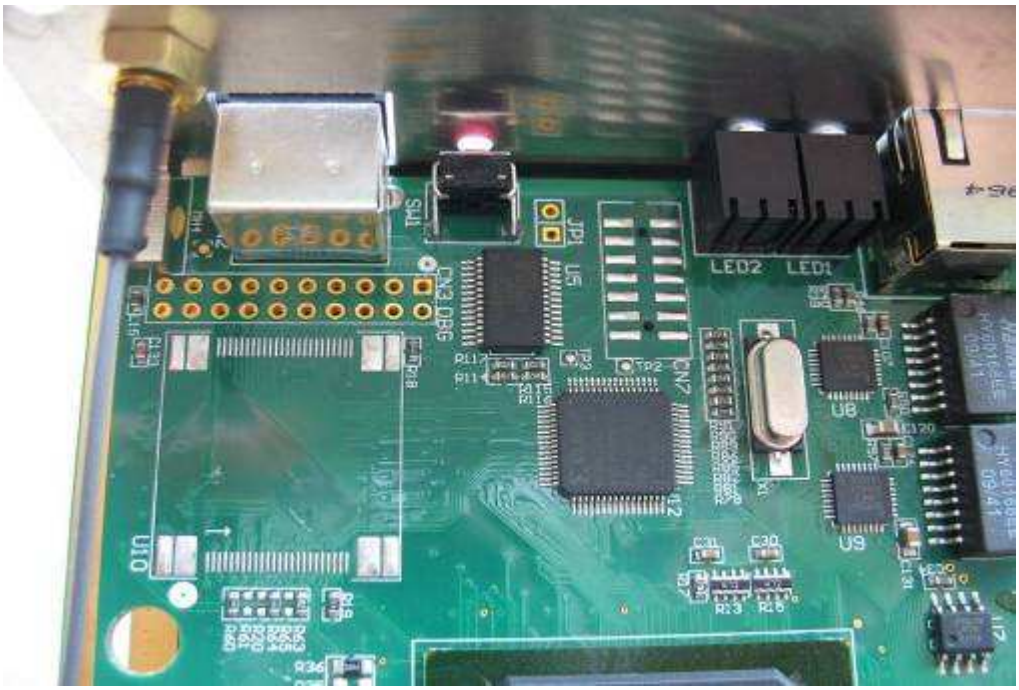


Photo 2:

Photo 3:



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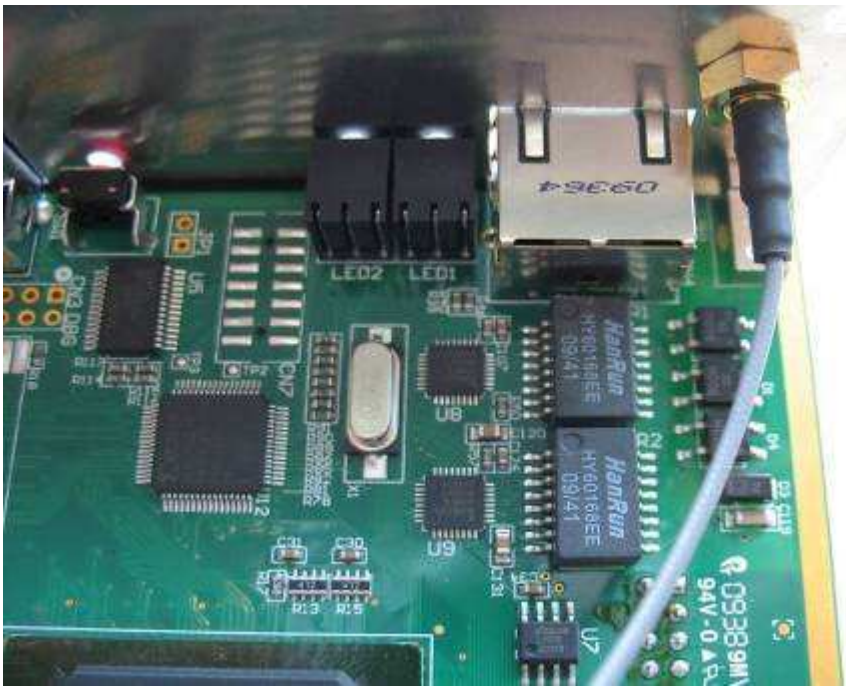

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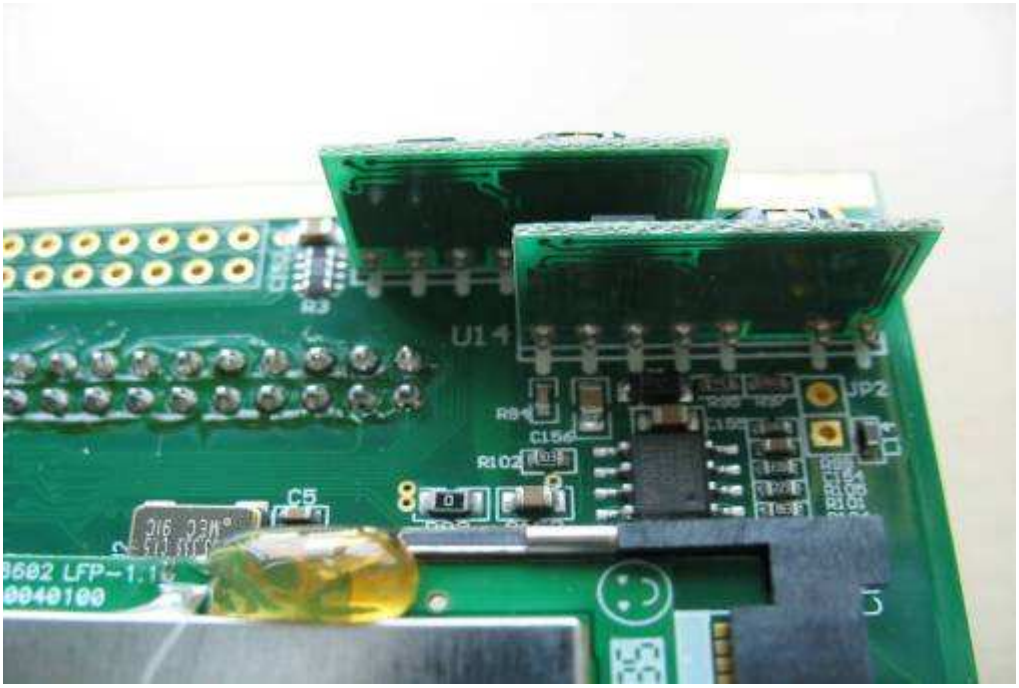
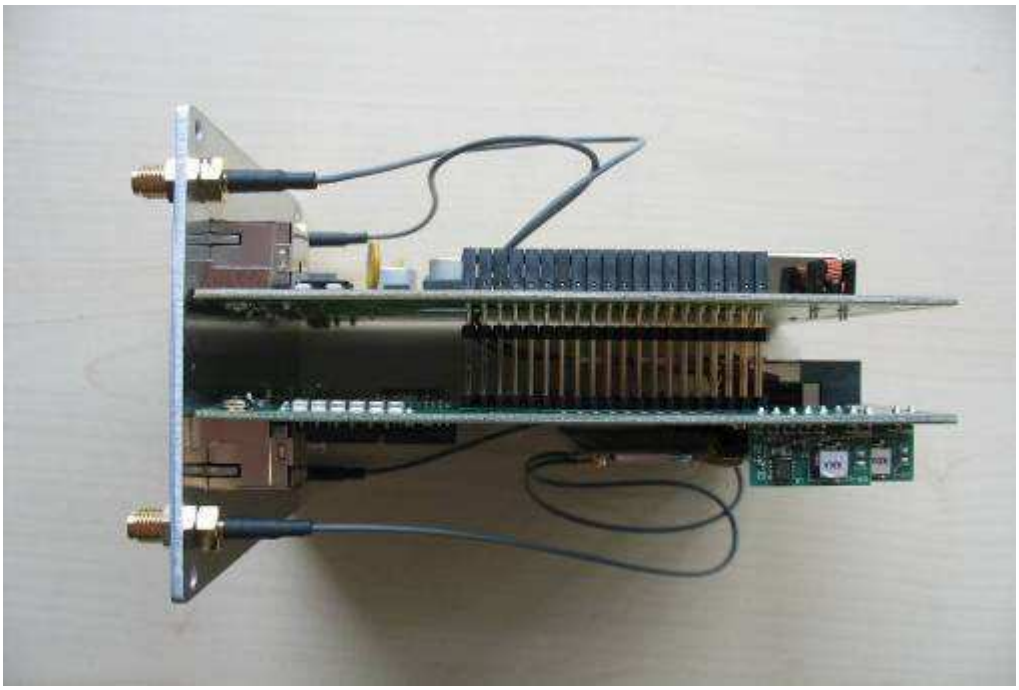


Photo 6:

Photo 7:



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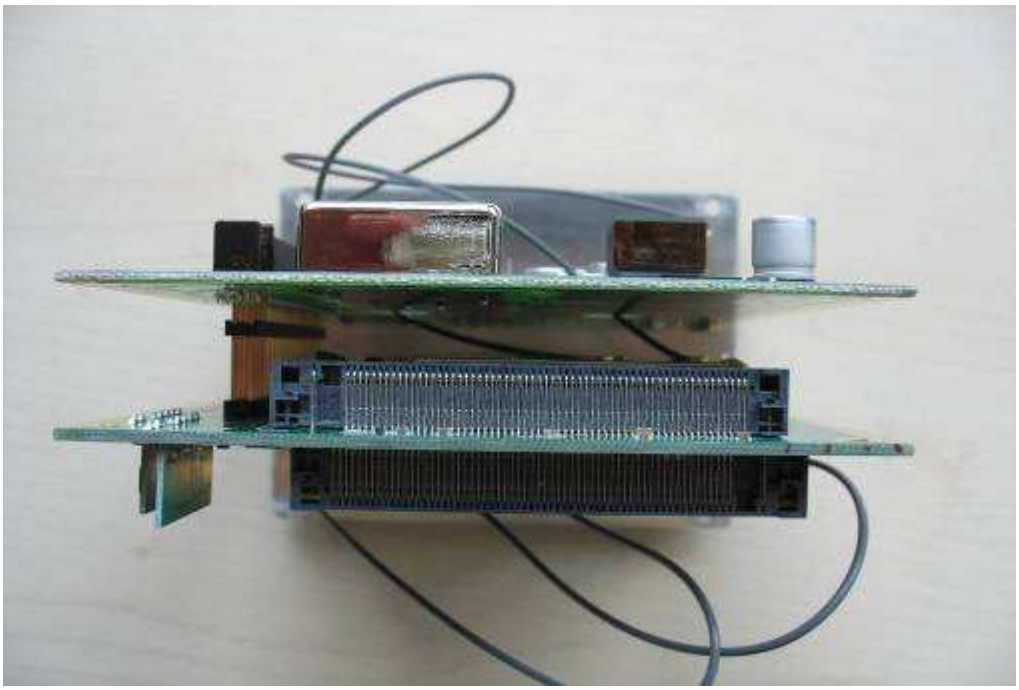


Photo 9:

Photo 10:

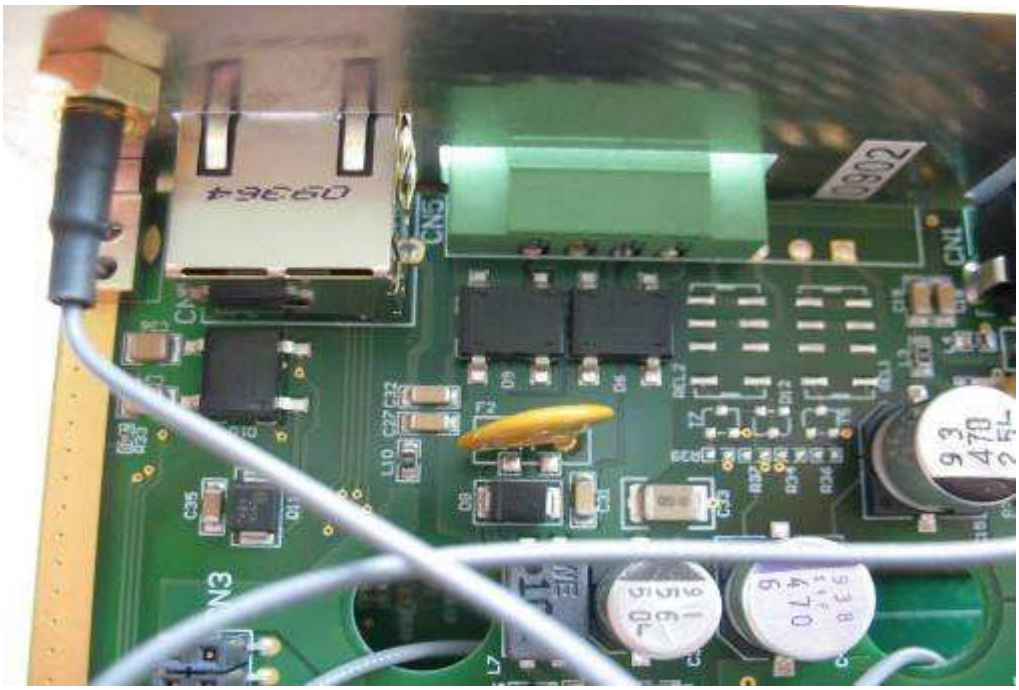


Photo 11:

Photo 12:

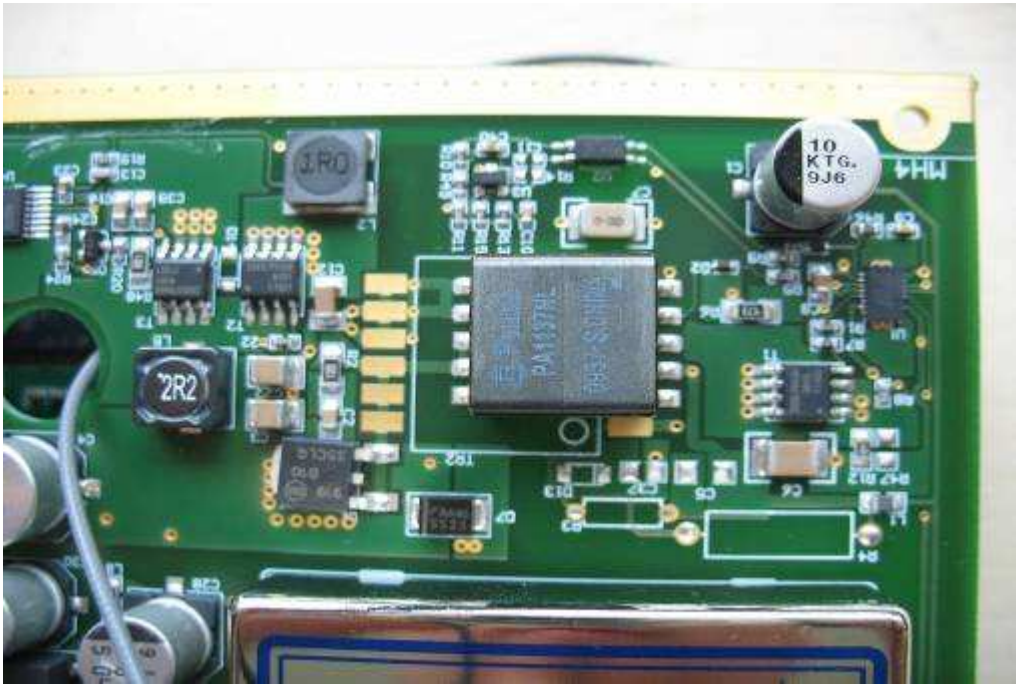


Photo 13:

Photo 14:

Photo 15:

Photo 16:

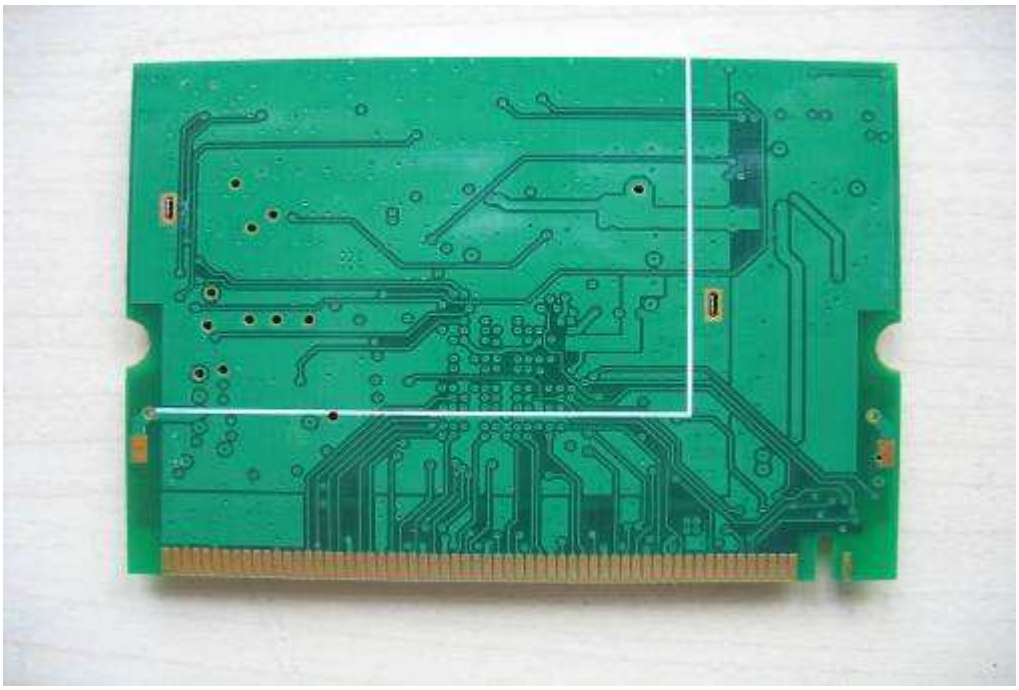
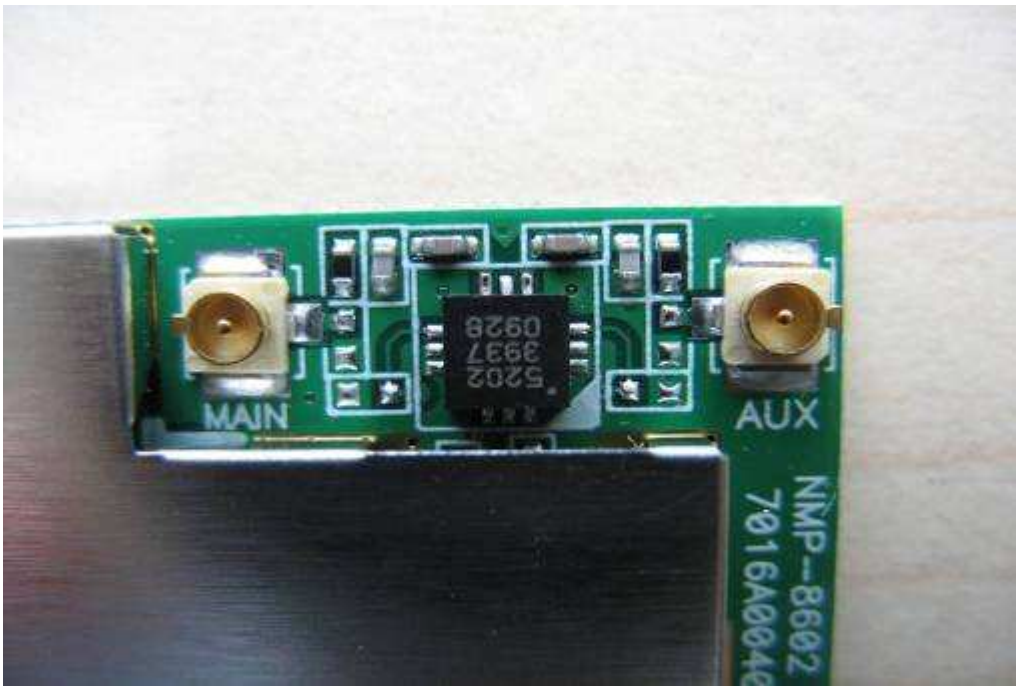


Photo 17:



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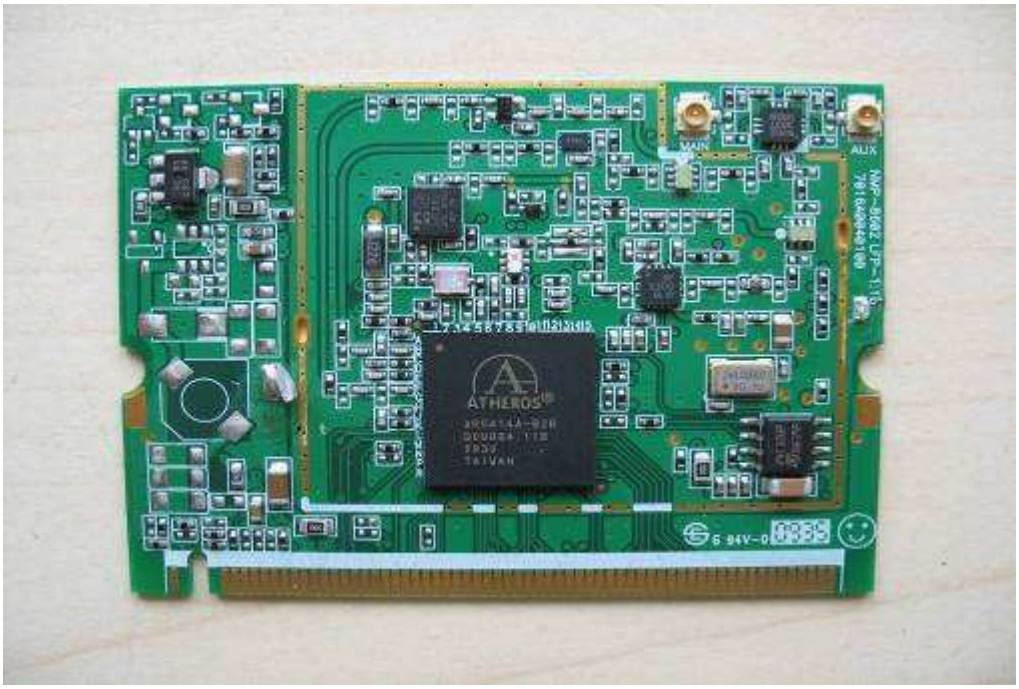

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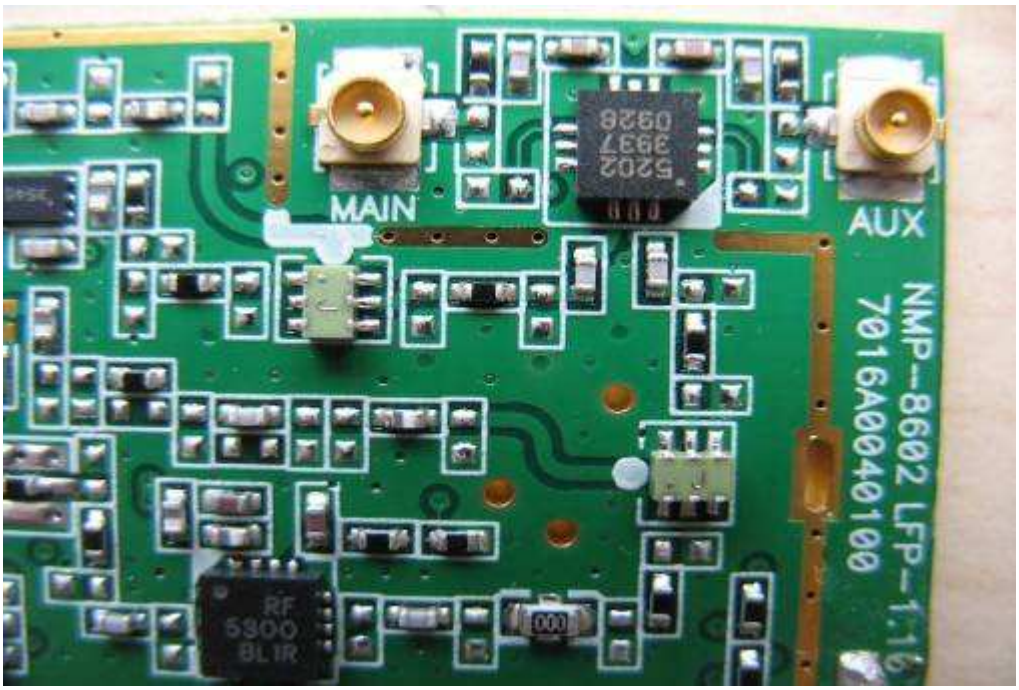
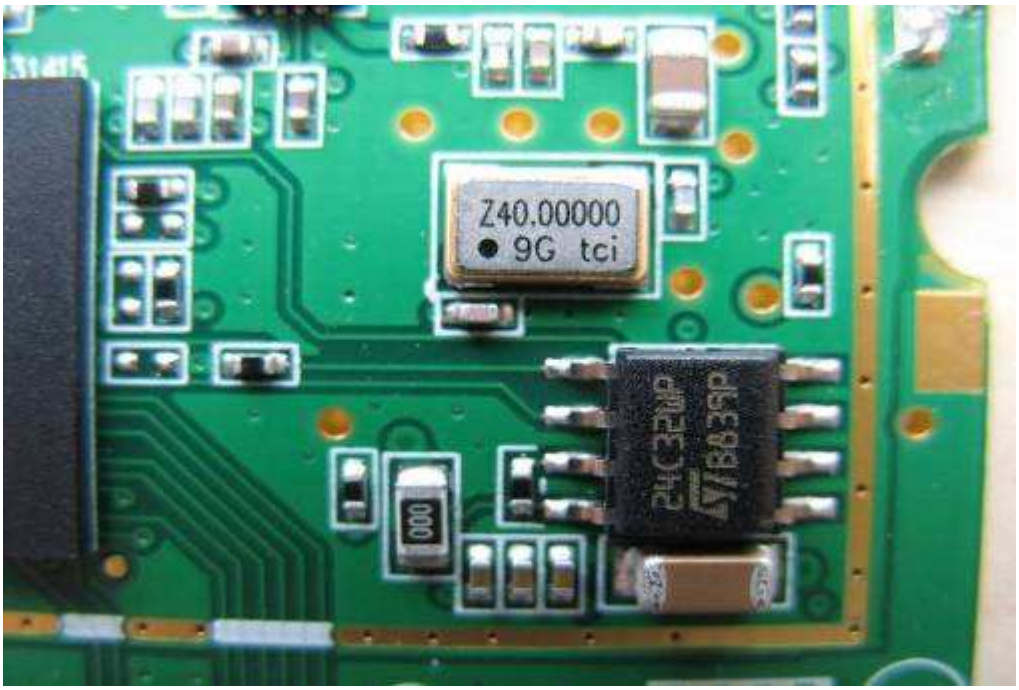


Photo 20:

Photo 21:



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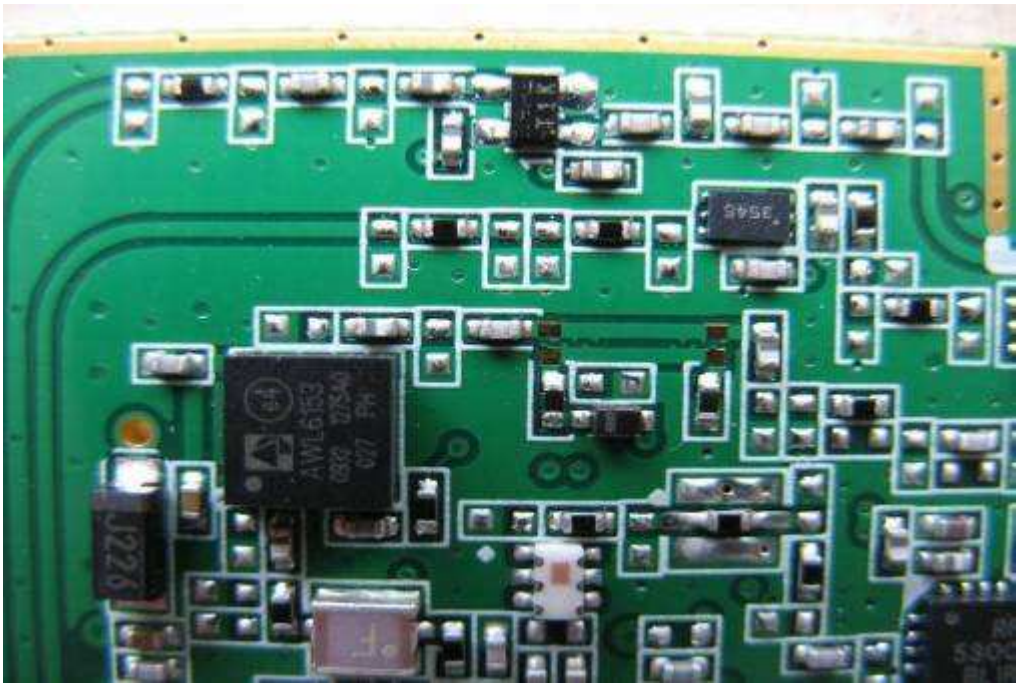

Annex D Document history

Version	Applied changes	Date of release
1.0	Initial release	2010-08-20

Annex E Further information

Glossary

DUT	-	Device under Test
EMC	-	Electromagnetic Compatibility
EUT	-	Equipment under Test
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	not applicable
S/N	-	Serial Number
SW	-	Software